ON THE COVER

OLD Broad Street Station in Philadelphia remained in service twenty years longer than it was supposed to. Its replacement, Broad Street Suburban, was completed in 1933, but the depression and then the war prevented making other changes essential to carrying out the midcity improvement plan. Finally, during the past year, wreckers went to work, and our cover picture was taken from the fourth floor of the 70-year-old depot as it was coming down. The latter frames the new Suburban Station, which has its terminal underground and is connected with City Hall and other nearby buildings by tunnels. From the street level up, the structure is occupied by Pennsylvania Railroad's general offices.

•

IN THIS ISSUE

ALTHOUGH Akron, Ohio, is the pneumatic-tire capital, numerous other sections contribute importantly to the huge annual output of the circular rubber air cushions on which the nation rides. In a rural setting at Indiana, Pa., the McCreary Tire & Rubber Company has been doing that for 37 years. Our leading article describes its operations.

•

ARCHEOLOGISTS have their own special ways of digging—careful ways that go just so far and no farther. Excavating with them used to be strictly a manual operation, but means are gradually being found to mechanize some phases of it. Page 100.

•

BACK in 1886 about 450 trains steamed into and out of old Broad Street Station in Philadelphia every day. By last spring the number was down to 90, and three other stations were handling the bulk of the passengers. Consequently, after 28 years of planning and rearranging, it became possible to raze the structure and its unsightly elevated approach. Memories of the days when they were important links with the outside world are revived in the story of their passing. Page 104.

•

CORRECTIONS

FLORIDA isn't exactly mountainous, but it has higher spots than we gave it credit for in the description of our March front-cover picture. Our figure of 32 feet for its loftiest point should have had a "5" on the end of it. And as Colin K. Lee of Webster Groves, Mo., was quick to point out to us, the word "smithies" was incorrectly used in the heading *The Timekeeping Smithies of Nottingham*, page 77. A smithy is a working place and a smith is the man who works there.

•

CREDIT FOR PHOTOS

THE photographs reproduced with the article, *Shifting Nashville's Freight Yards* in our February issue (pages 48-49) were provided by Hurst Construction News, Nashville, Tenn.

Compressed Air Magazine

VOLUME 58 **April, 1953** NUMBER 4

EDITORIAL CONTENTS

ADVERTISING CONTENTS

A monthly publication devoted to the many fields of endeavor in which compressed air serves useful purposes. Founded in 1896.

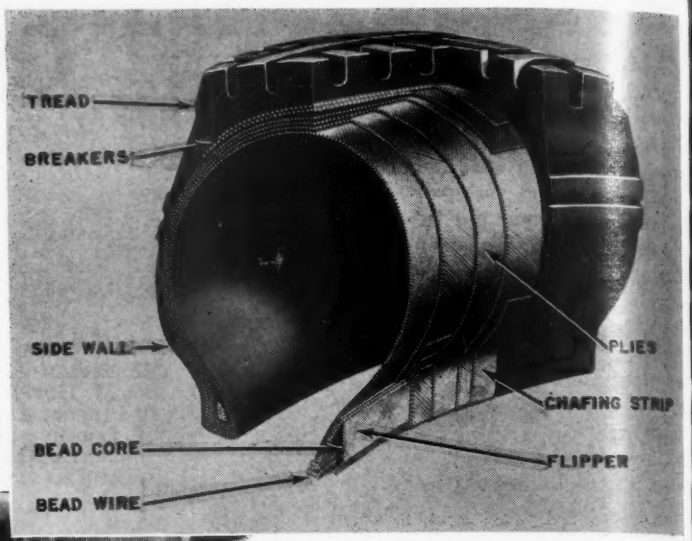
CCA Member Controlled Circulation Audit

Published by Compressed Air Magazine Co., G. W. MORRISON, *President;* C. H. VIVIAN, *Vice-President;* A. W. LOOMIS, *Vice-President;* J. W. YOUNG, *Secretary-Treasurer.*
Editorial, advertising, and publication offices, Phillipsburg, N. J.
New York City Office, 11 Broadway. L. H. GEYER, *Representative.*
Annual subscription: U.S., $3.00, foreign, $3.50. Single copies, 35 cents.
COMPRESSED AIR MAGAZINE is on file in many libraries and is indexed in Industrial Arts Index and in Engineering Index.

Tire Plant in the Country

McCreary Company Factory at Indiana, Pa., Is Small But Thoroughly Modern

J. C. Pierce



MAKE-UP OF TIRE
Cutaway illustration of a 4-ply tire with the various components designated.

BIRTH OF A TIRE
In the opened mold of the steam-heated vulcanizing press at the left is a tire that has just been cured. Hanging from the conveyor are a "green" carcass (extreme left) as it looks when it comes from the tire-building machine and an expanded one (above the operator's head) in which an air bag has been inserted. McCreary makes tires of 102 type-and-size combinations, most of them for trucks and buses.

TUCKED away from beaten paths and busy industrial centers in a peaceful farmside setting on the outskirts of Indiana, Pa., is the McCreary Tire & Rubber Company plant where big things are done in a small way. Founder Harry McCreary thought a tire factory in the midst of the western Pennsylvania coal fields would be a good business enterprise for the community and a needed stabilizer. More than 37 years of unbroken operation has proved that he was correct in his surmise. Surges in producing coal—the area's principal activity—are equalized by the

company's annual million-dollar payroll. The aim McCreary had set himself was not to make the most tires but to make the best. That guiding slogan has been held before the employees since the plant opened in May of 1915.

Being a small factory with a daily capacity of 600 tires doesn't prevent it from keeping pace with improvements in technique and equipment in the industry. In fact, it is modern in every respect and has a well-equipped research laboratory and an Akron standard-mold test wheel to maintain the position it has won in this highly competitive field. With its facilities and some 270 employees working three shifts, McCreary produces 102 different size-and-type combinations, with most of the output centered on truck and bus tires.

The matter of raw materials in tire manufacture is impressive. Many ingredients other than rubber and fabrics are needed to build today's rugged tires, and McCreary's receiving room is piled high with some 50 different kinds from near and far. The nature of these diverse products—clay, carbon black, zinc oxide, petrolatum, natural and synthetic rubber, sulphur, naphtha and stearic acid, to name only a few—denotes the extent to which tiremakers are dependent upon other industries and how important a part they play in the great American economic scheme.

Rubber-impregnated fabrics, beads and tread are the principal parts of a tire, and many painstaking operations are required before the raw materials that enter into them are ready for assembly. Rubber, textiles, chemical compounds and steel wire must be expertly combined so that the components can be shaped and transformed into modern tires. Precise control of temperature, pressure, ingredients and machinery is essential at every stage of the work, and in this service compressed air plays an important part. In fact, air under pressure has been intimately associated with tires since 1845 when England's Robert William Thompson conceived the idea of supporting vehicles on tubes cushioned with compressed air. Since then, although many substitutes have been tried, none approaches that medium in effectiveness. In the meantime, compressed air has become indispensable also in the manufacture of tires.

The rubber that goes into a tire at the McCreary plant may be either natural, synthetic or both. Natural rubber is received in 225-pound bales and is cut into sections about 4 inches thick and a foot square for ease of handling. Being tough, it is hard to cut by normal methods but parts neatly when forced by a motor-driven plunger against electrically heated knives. Synthetic rubber comes in 75-pound packaged slabs that can be fed into compounding machines without size reduction.

Proportioned quantities of rubber and other raw materials required to produce a tire that will meet rigid specifications go into a Size 11 Banbury mixer for what is known as mastication or milling, a process that was developed in the early nineteenth century by Thomas Hancock who found that rubber could be softened and plasticized by working it mechanically. The mixer contains two rotors that are driven by a motor through a speed reducer and that tear the rubber apart, squeeze and compress it into a soft, pliable mass. A Size 11 Banbury has a capacity of about 66.5 pounds per minute, as against 2.6 pounds in the case of a large-size open mill in which the material is fed into a narrow space between two rolls turning at different speeds in opposite directions.

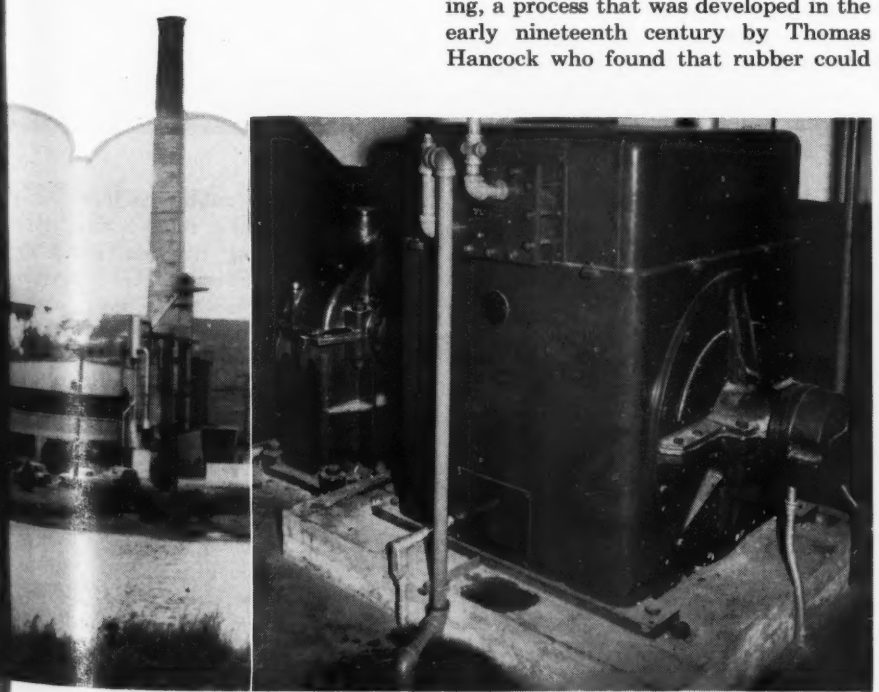
The ingredients which are added to rubber at this stage determine the physical characteristics of the finished stock and thus the part of the tire for which it will be used. Rubber specifications for tread, sidewall, etc., vary considerably. The additives are generally in a dry, powdered form and may include the reinforcing and filling pigments that give stiffness, strength and resistance to abrasion or to chemical action, as well as color pigments, softeners, and possibly some of the vulcanizing agents and accelerators, age resisters and special-purpose compounds.

The tiremaker is the principal industrial consumer of carbon black. In the early days that material served only to impart the black color, but then it was discovered that black tires were much more wear resistant than those without that ingredient. Now tire-tread rubber normally contains about 30 percent carbon black. But this angel of the tire manufacturer can also be a satan if not carefully controlled. It is used in the form of a superfine dust, which finds its way into the housings of electric motors where it gradually destroys the insulation's resistance until flashover occurs. To safeguard motors as well as to practice good housekeeping, great pains are taken to trap and remove all the carbon black at the point of application. At the McCreary plant, a large-diameter pneumatic suction tube extends to the intake of the Banbury mixer to whisk away the dust and paper bags in which the powdered ingredients are delivered in accurately weighed quantities. As an extra precaution, motors in the mill-room are shielded from dust.

Sulphur is the only additive that cannot be put in the batches made ready for the first of two passes through the Banbury. It is the principal vulcanizing or curing agent and should not be present where temperatures might exceed 290°F, the point at which vulcanization begins. As might be expected where extreme frictional forces are at work, a great deal of heat is generated in the

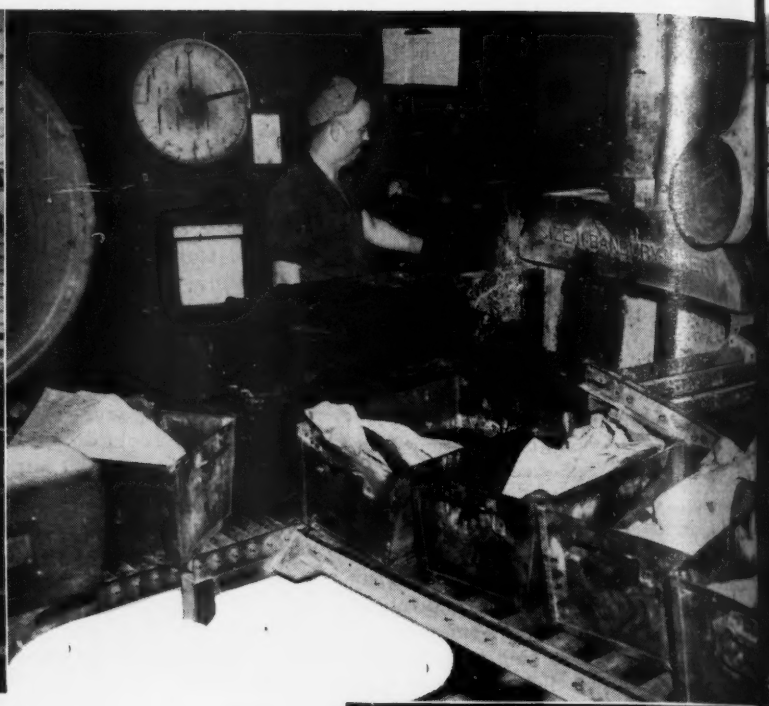
RURAL FACTORY SETTING

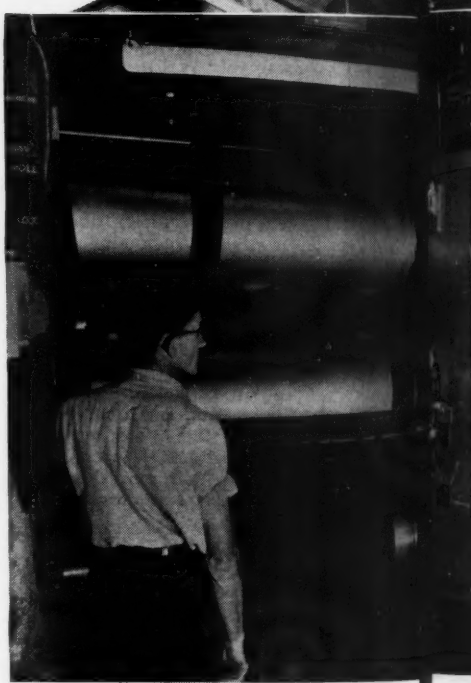
The McCreary plant (below) doesn't lack space or clean, fresh air. The pond in the foreground is now provided with a spray system to supply additional cooling capacity during hot weather. The stack marks the location of the power plant that houses coal-burning boilers and steam-driven generators ranging in capacity from 100 to 540 kw. Offices and manufacturing departments are in the center of the picture, and at the left are a warehouse for finished tires, the shipping department and an employee recreation room.



PROTECTED MOTOR

Tire-tread rubber contains 30 percent carbon black. During compounding, it is added as a fine powder, which is a source of trouble. Exhausters draw much of it away, but sometimes motors are nonetheless enclosed, as shown at the left, to protect their inner workings.





mixer and, unless controlled, would cause vulcanization, which must be avoided until the end of the operations when the assembled tire components are molded into one unit by heat and pressure. In other words, if any part is inadvertently cured at an early manufacturing stage it would not unite with the other members and an imperfect product would result.

Incidentally, the process of vulcanization is declared to be the most important basic development in the rubber industry. It was discovered accidentally by Charles Goodyear in 1839 when, in the course of his research work with rubber, he dropped some gum elastic mixed with sulphur on the stove in his kitchen. The gob he scraped off possessed many of the qualities that he had been trying to impart to rubber.

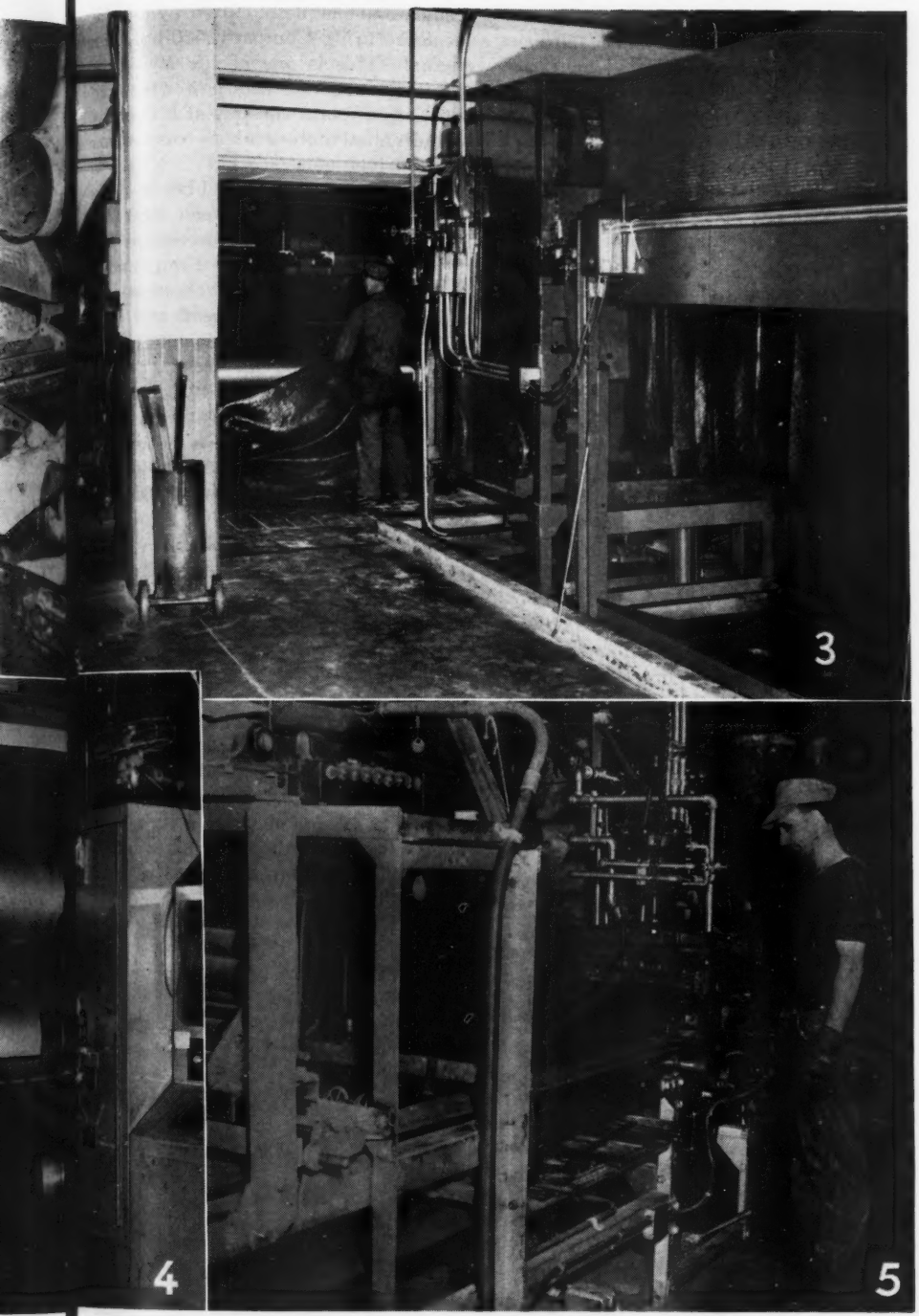
Heat is generated at many other points in the plant where rubber compounds are mixed or formed. Some increase in temperature is desirable and frequently intentional to condition the materials for subsequent operations, but it must be kept below vulcanization level. This is done by circulating cool water through the rolls and body of the Banbury and the rolls of calenders, mixing and warming open mills, extrusion machines (tubers), etc. To provide the large volume of cooling water needed for this purpose, an Ingersoll-Rand steam-jet refrigeration unit is used in conjunction with a cooling pond.

When the 400-pound batch is in the Banbury, a pneumatic ram is lowered onto the mass to force it into the digesting rolls. As the raw rubber is torn asunder and thoroughly mixed with the powdered ingredients, gobs of the masticated material drop out and are fed into an 84-inch mill, known as the sheet-off mill, which has water-cooled rolls and produces a ¼-inch-thick continuous sheet of "green" or unvulcanized rubber. This goes to a batch-off machine which passes it through a soap solution to reduce its tackiness and cuts it into 3x6-foot slabs that emerge on a moving conveyor where they are cooled by a stream of air from a fan. Folded into easily handled sizes, the slabs are transported to the Banbury for compounding with sulphur and possibly a few other ingredients. As the green rubber entering the Banbury is as soft as putty, the temperature generated during this second pass through the mixer is not as high as during the first one and there is no danger of vulcanization, even though sulphur is present.

After the second pass through the Banbury and the sheet-off mill, the rubber is further mixed as it is rolled by open mills into sheets of desired thickness for subsequent processing. From this point on the material, depending upon the application for which it is compounded, is variously routed to a calender which rolls it into sheets that are pressed into prepared cotton or rayon cloth, to a tuber from which it issues in properly dimensioned strips for treads, or to an extruder which combines it with wire to form tire beads. Camelback—tread rubber that is shipped to retread shops—forms a substantial part of McCreary's production. It is backed with rubber-coated polyethylene to which green rubber will not stick here.

Plies of rubberized cord fabric are the foundation upon which tires are built. These tough sinews, when chemically treated, rubber-impregnated and expertly joined, form the base on which the beads, flippers, breakers, sidewalls and treads are assembled. The cord is as important as the rubber itself in making tires that will meet today's rigid specifications covering traction, shock absorption and wear resistance. For years, long-staple cotton was the most popular material, but of late many manufacturers prefer rayon for their premium-grade tires and particularly for service where heavy loads have to be supported at sustained high speeds. McCreary uses rayon for plies and cotton around the steel bead area.

Fabric suitable for tiremaking presented a major problem in the early days, and its development entailed years of painstaking research. When the first all-rubber pneumatic tire made its appearance it was realized that tough sinews of some sort were needed to hold



WORKING THE RUBBER

1 RUBBER CUTTER: Crude rubber is received in 225-pound bales and reduced to sizes that can be manually handled. It is cut by forcing it by aid of a motor-driven plunger assembly against the electrically heated knives seen at the far end of the machine.

2 COMPOUNDING: Initial mixing is done in a No. 11 Banbury by an operator who knows his formulas like a chef knows his recipes. The metal boxes contain weighed and bagged additives for a 400-pound batch. In front of the worker is a pile of rubber that has been through the mixer once. The masticating, water-cooled rotors of the Banbury are driven by a 600-hp. motor. Atop the mixer is a large air cylinder that actuates a plunger in the throat of the machine to hold the charge against the rotors, the pressure used being varied by controlling the air admitted to the cylinder. The round dial behind the operator is a timer, and the square chart below it is a temperature recorder. At the right of the mixer is the intake of an air-operated paper-bag and dust disposal system.

3 GOB TO SHEET: This 84-inch mill receives gobs of compounded rubber by gravity from the Banbury mixer and rolls them between its water-cooled cylinders into sheets of green rubber 1/4 inch thick. On the right is a batch-off machine that removes the material from the mill, runs it through a soap solution, cuts it into slabs and hangs them on a moving conveyor to cool in a stream of air.

4 CALENDERING: This 3-roll, water-cooled calender is used to coat rayon tire fabric with rubber. On the extreme right is the control panel of a beta-ray gauge that continually records the weight of the material in pounds per square yard as it is being calendered. The strip of rubber being fed into the machine from above came from the nearby warm-up mill that conditions the compounded rubber for this precise operation.

5 EXTRUDER: This 8-inch tuber is extruding a tire tread that is being carried away by a conveyor belt. A scanning electric eye controls the speed of the belt so as to insure treads of uniform weight.

the unit together. Experiments with malleable-iron wire and other materials were abandoned in favor of cotton. However, because the intersecting threads of that fabric were continually flexed in service they sawed against one another, thus weakening them and generating heat that burned the life and resilience out of the tire.

Different weaves were tried and resulted in a material with cords running in only one direction and held together by fragile cross threads that broke in the mold during vulcanization. That construction proved to have marked advantages, and researchmen pursued their investigations to find a pattern that would reduce fatigue and give added strength. The plies of present-day tires are made up of parallel cords of a special weave insulated from one another by a layer of rubber during the calendering operation, which is discussed later. But when the low-pressure tire became popular, flexure increased appreciably both in number and extent and necessitated an improvement in cord design. Rayon then entered the field by reason of the fact that it proved to be resistant to the destructive internal heat caused by excessive flexing.

Rayon cord is delivered to the McCreary plant in 600-yard rolls 4-feet wide and is treated with Lotol, a solution of synthetic-rubber latex, plus certain chemicals that give the fabric added strength and a certain amount of resilience. This is accomplished by machinery which unwinds the roll as it passes through a bath of Lotol and rewinds it for drying, which is done with the aid of infrared lamps in a large oven heated by steam at about 300°F. Then the material is taken to an air-conditioned room to await further processing in a calender. Dipping is a continuous operation, the end of one roll being spliced to the next in line in a matter of 25 seconds by use of a quick-curing cement and vulcanization in an electrically heated press at 400°F.

The calender is a triple-roll machine in which the fabric is thoroughly impregnated with compounded rubber under carefully controlled conditions. To insure perfect union, both the rayon and the rubber must be at the exact tem-

peratures specified, and to that end the hollow rolls are supplied with steam and cold water, as required. The amount of rubber applied to the cords also must be closely regulated. To achieve this, nuclear physics has been brought into play in the tiremaking industry. Hand gauges and visual inspection have been replaced by a beta-ray instrument that automatically measures the material and records its weight. It is a Model R AccuRay manufactured by Industrial Nucleonics Corporation and consists of a gauging element and of a visual indicating mechanism. The former is made up of a split arm through which the calendered fabric travels. The radioactive source—Strontium-90—is in the lower branch of the arm, while the detector is in the upper one. The intensity of the radiations after penetration varies with the weight of the material and is registered directly in pounds per square yard on the recorder at the calender-operator's station. Thus, he can tell at a glance whether or not the rubber-coated fabric meets specifications and make adjustments before tolerances are exceeded. The net result is a saving in both labor and rubber and a product of uniform quality.

Following this first pass through the 30- to 40-yard-per-minute calender, the material, now coated on one side, is run into a tower of open rollers where it is air cooled by means of fans and rewound with a nonadhesive liner. A second pass through the calender coats the other side. After being cooled and rerolled, the fabric is cut into breakers and plies for tires of different types and sizes. Cutting is done on the bias so the layers will conform naturally to the tubular section and the cords of one ply will not parallel the cords of the adjacent ply. The strips are then cut into proper lengths and rolled individually for the convenience of the tirebuilder.

The rigid ring found on the inner periphery on each side of a tire is called the bead. It must fit the wheel rim perfectly and is therefore tailored with precision. The copper-coated steel wire and small strips of rubber used in making the bead are kept in a room maintained at 120°F and fed into a machine that extrudes the rubber onto the wire, which is further heated by a gas flame. Many of these rubber-covered wires, cut to length, are wound into a bundle and wrapped with rubber-treated cotton fabric to form the bead core. For heavy tires these cores are wound one or more times with "noodles"—extruded rubber strips—and wrapped, as before, with rubber-impregnated cotton.

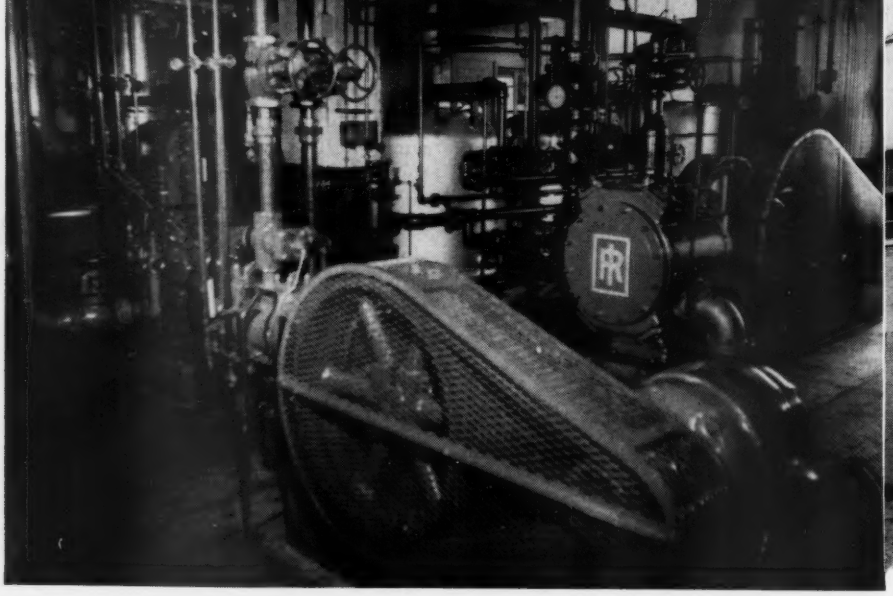
The three open mills that condition the rubber for treads, camelback, noodles and sidewalls are on the floor above the extruders and are driven through a shaft and magnetic clutch by a Vilter Manufacturing Company 500-hp steam engine. This is one of the few places where steam serves as a power medium. Most of the plant equipment is operated by individual motors taking current from steam-driven generators.

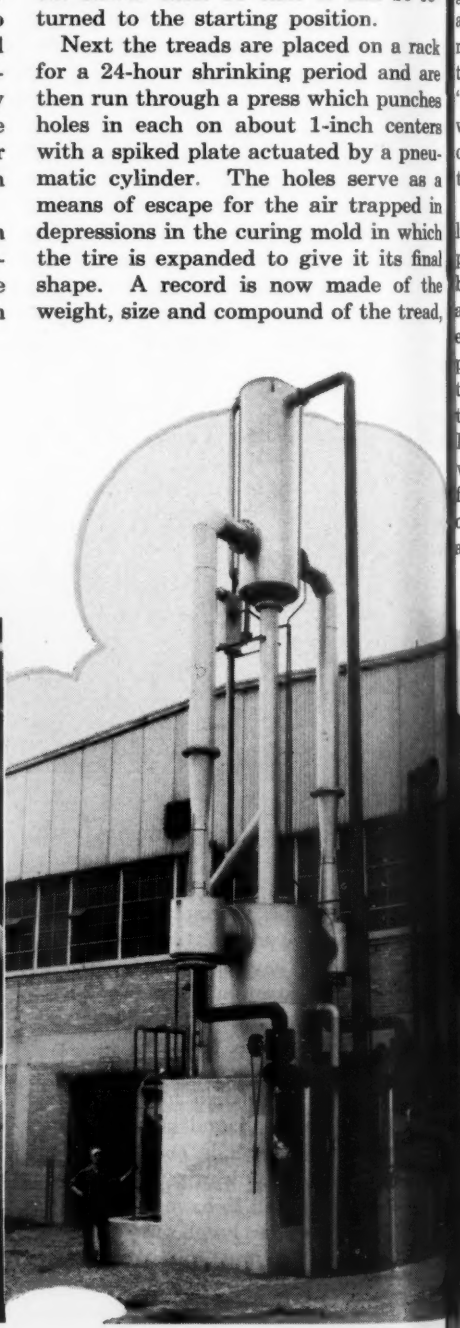
When the plasticized rubber is at the right temperature—between 180 and 225°F—it is fed in narrow strips into the tuber for which it is compounded. It enters by way of an opening in a cylinder with a heated head and a revolving screw that forces it out through a die. If intended for treads, the extruded material is cooled by running it through a tank of cold water before it is conveyed to the skiver—a motor-driven, water-lubricated circular knife that cuts it into proper lengths by aid of an electric eye. After each cut, an air cylinder lifts the knife mechanism above the skiver table so that it can be returned to the starting position.

Next the treads are placed on a rack for a 24-hour shrinking period and are then run through a press which punches holes in each on about 1-inch centers with a spiked plate actuated by a pneumatic cylinder. The holes serve as a means of escape for the air trapped in depressions in the curing mold in which the tire is expanded to give it its final shape. A record is now made of the weight, size and compound of the tread,

ACCESSORY EQUIPMENT

Shown here are different types of Ingersoll-Rand equipment which render essential services in and around the factory. Below are three compressors that furnish air at 100 psi pressure for operating the expanders and the Banbury plunger, for the air bags used in the tiremaking process and for general plant purposes. The apparatus stationed outdoors, right, is a steam-jet refrigeration unit that chills about 2700 gpm of water to 55°F for cooling the heat-generating rubber-working machines. On the next page is a battery of Cameron pumps. Some of them supply the flash chamber of the refrigeration machine with water; others deliver chilled water from that unit to points of use; still others serve the spray heads at the cooling pond and furnish water for general application.





of the date and the operator handling it.

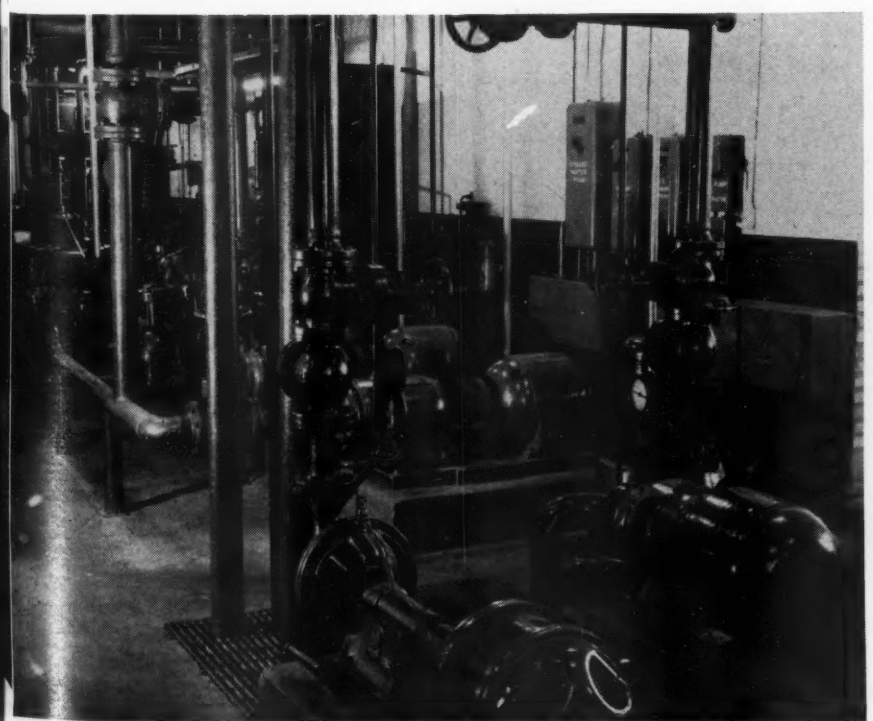
All the components of a tire are routed to a common point—to the builder with his collapsible revolving drum or form. On this cylinder he expertly lays a number of plies with the cords of the first one running in one direction and those of the second in the opposite direction, and so on, to form a weave that will insure a product possessing strength and flexibility. Next come the beads, flippers, more plies and breakers (parts between the plies and the tread) for additional strength; then he places chafing strips around the bead for further protection against rim wear; and finally the sidewall and tread are put in position.

As assembly proceeds, the builder is busy directing high-pressure rollers and other shaping tools against the form in order to tie all the parts securely together. Called "stitchers," the rollers are mounted on arms powered by pneumatic cylinders. When satisfied with the job, he collapses the drum, and the "green" tire, which looks like a barrel without heads, is slipped off and hung on an overhead conveyor traveling to the next manufacturing stage.

The embyro tire is now given preliminary shape in a pressure-vacuum expander. In this ingenious airtight chamber it is laid flat on a pneumatically operated vertical ram which, when raised, exerts pressure against both sides of it, pushing the walls inward. At the same time an outward pull is exerted on the tread by suction created by an Ingersoll-Rand air compressor converted into a vacuum pump. The result is a crudely formed carcass into which an air bag, often called "curing tube," is forced by a pneumatic ram and inflated with air. But before this is done, a soapstone-naphtha lubricant is sprayed on the inner wall of the tire. The bag is made of a specially compounded rubber for toughness and coated with glycerine so it won't adhere to the tire during molding.

Next comes the most important step in the whole process—vulcanization or curing in a split mold which receives an object that wouldn't support your car around the block and transforms it into a tough, sinewy tire that will take road abuse for thousands of miles. Temperature, pressure and time must be carefully controlled during the operation, which takes about 40 minutes for the average automobile tire and as much as 2 hours in the case of a large truck tire.

The inner walls of the mold, like a giant waffle iron, have all the characteristics and features of the finished product. When the carcass is admitted, the contained air bag is attached by means of two connections to a hot-water system that circulates water at 320°F and 240 psi pressure through it. Simultaneously, steam in the mold case raises the mold-plate temperature to about 300°F. Each press is equipped with a Taylor Instrument Company Flex-O-Timer that automatically regulates the length of the curing period and with a Fulscope that controls and records the temperature in the air bag and in the mold to bring about optimum results. Air at 20 psi is used to actuate the Flex-O-Timer, which is essentially a motor-driven drum with adjustable pins. The latter trip pilot air valves which, in turn, open or close steam, water and air valves at the proper time during vulcanization. Between curing cycles the mold is blown clean with compressed air and is then sprayed with a silicon-base lubricant that prevents the tire from sticking to the mold.



Bag curing, as described, has some serious drawbacks, which have been successfully overcome in recent years through the development of an automatically operated vulcanizing press by The McNeil Machine & Engineering Company, Akron, Ohio. In this press, called the Bag-O-Matic, the expanding bag is incorporated in the mold. Although the plant has doubled its capacity since 1949, when the machine was put in production, output has lagged far behind demand, and McCreary has had to wait until this year to install its first unit.

The advantages of the Bag-O-Matic over the older system are manifold. In the case of the latter it is necessary to carry a large stock of air bags of different sizes corresponding to the tire sizes manufactured. At the best, their life is relatively short, for they are generally useless after approximately 100 "cures." To safeguard against failure when in the mold, each bag is tested for leakage after every application by inflating it with air and immersing it in water. A pneumatic ram holds it submerged, and the presence or absence of bubbles gives visual indication of its unfitness or fitness for further use. When the tire is removed from the mold it goes to a debagging device which distorts it and holds it open at one point by an air cylinder while a hook at the end of the piston grabs the curing tube and pulls it out.

The bladders built in the McNeil press are good for some 300 cycles even though they are thinner walled than the conventional type to permit more rapid heat transfer. A plant fully equipped with such units needs no bagging and debagging departments, no conveyor system to connect the two with the vulcanizing room and no pressure-vacuum expander, because everything required for final shaping and curing is incorporated in the Bag-O-Matic. Costly rejection of tires damaged during bagging and debagging are eliminated, and one operator can easily take care of as many as twenty presses (40 molds) that take up no more space than the older machines and reduce vulcanizing time by 30 to 40 percent.

When a McCreary tire comes from the mold it is ready for finishing, which includes removing mold extrusions, cleaning and polishing the exterior surface, balancing it to mark the point where the inner-tube valve stem should be put and painting the outside with a spray gun. Then it is visually inspected for defects. If up to standard, it is conveyed to the shipping department. This is in an adjoining building and is modern in every respect—even boasts a pneumatic-tube system connecting it with the main office for the fast exchange of messages.

Delving into the Past with Modern Tools

To Save Time and Money the Technique of Archeology Is Undergoing Changes

Charlie R. Steen

PRELIMINARY EXCAVATION

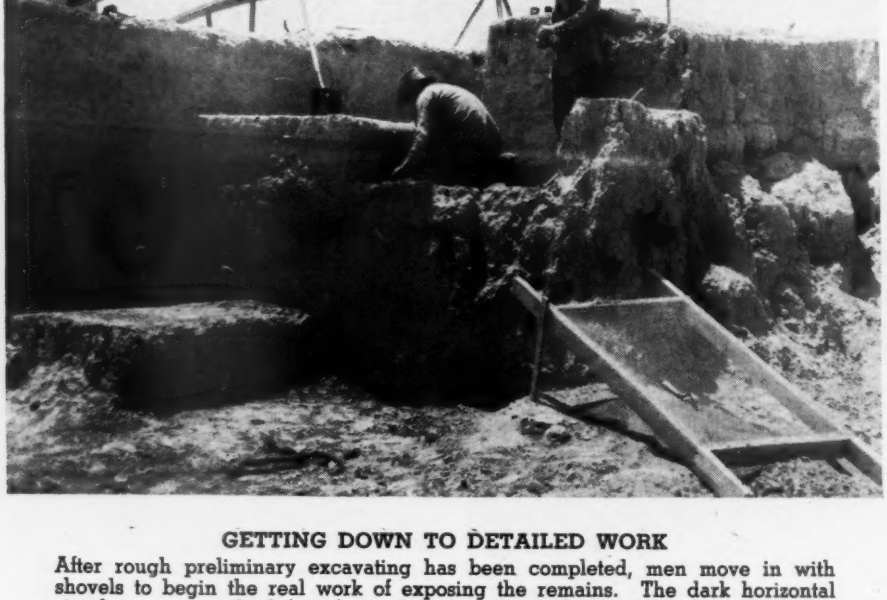
Where conditions permit, overburden is excavated with bulldozers down to the previous "occupational" level where study is to begin. To make sure that preliminary digging will not go below the desired horizon, a trench is first dug with hand tools, and paper targets are placed in a line, as shown, about 6 inches above the objective, plus the height of the dozer blade. The earth above this level is then removed in a series of pushes.

THE archeologist has long been noted for using the smallest of tools. He is usually pictured squatting beside the bones of some long-dead hunter painstakingly removing soil from the bones with pointing trowel, dental tools and small paintbrush. There are very good reasons for the exercise of care and skill, because bones and other remains that have been buried for hundreds or thousands of years in damp earth are often so rotten that they disintegrate upon exposure for study. In the case of particularly important finds, skeletons must be uncovered a little at a time and each section allowed to dry before painting it with a hardener and preservative, usually a synthetic resin.

It is the archeologist's job to reconstruct, as completely as possible, the life of our human predecessors—of groups of men who existed in the days before systems of writing were developed. The materials he has to work with are pitifully small, and he cannot hope to discover at any site most of the tools and utensils used by the people who once dwelt there. Imagine what would happen if one of our modern towns or villages were suddenly abandoned. The inhabitants would take with them all objects they considered valuable and would leave a litter of broken tools, furniture and so on.

It doesn't take long for deserted houses to start falling apart. Roofs soon cave in, walls topple, and within a "few years" a series of mounds marks the sites of former homes and crumbling masonry rises here and there above the midden. A "few years," incidentally, means a short period in relation to time as measured by those who deal in centuries rather than in terms of one man's life span; a couple of generations would probably witness the complete disintegration of even a well-built modern town.

And what of the things remaining in and around the houses? Paper, textiles, wood, and many metals would soon rot, while some perishable materials, burned but not entirely destroyed, would, like charcoal, last wellnigh forever but would be so fragile that slight handling would cause them to crumble into black dust. So, our abandoned community, once full of useful and beautiful gadgets and conveniences, would be mostly heaps of rub-



GETTING DOWN TO DETAILED WORK

After rough preliminary excavating has been completed, men move in with shovels to begin the real work of exposing the remains. The dark horizontal streak running to the left in front of the kneeling workman was made by an accumulation of charcoal at a level that was the ground surface during some previous period of occupation. The picture was taken within the reservoir area to be created by the erection of Falcon Dam in Texas.

ble containing glass, pottery, bricks, and rust-resisting metals—the same sort of residue with which the archeologist must piece together the story of ancient civilizations.

Reconstructing the past has been greatly aided by the fact that man, no matter where or when he lived, has usually sought the same sort of location for his home, one that met his needs—proximity to food supply and water, a moderate amount of shelter from prevailing winds and adequate drainage. As a result, groups of people have often dwelt continuously or at intervals in one area over great stretches of time. Today there are towns in the United States built over prehistoric Indian villages, and in the Old World many cities, notably Paris, Rome, Athens and Jerusalem, have been inhabited for thousands of years.

As primitive man tossed broken or discarded tools and other possessions onto trash piles, the latter grew until they became great mounds, or, where refuse was simply thrown outdoors, entire townsites gradually rose higher and were built on ever-mounting midden. This is well demonstrated in some parts of India, particularly in the flatlands of Bengal where small villages have occupied the same spot for several hundred years and now rest on hills of debris 6 to 10 feet high. If one of these piles were excavated, the remains of the first people who lived there would be found at the lowest level and near the center, while higher levels would represent later periods of occupation.

In exploring such mounds the archeologist's chief concern is to record the positions of artifacts in proper relation to one another and to the strata of earth which overlie the original site. Styles in dwelling places, wearing apparel and tools changed in the past as they do today and are revealed by slowly and painstakingly removing the soil in layers. Aside from discarded objects, house floors, storage pits, burials and other structures give him information. In the case of a grave, for instance, it is possible by carefully excavating with a trowel to establish its relationship to a particular level in the mound, for the disturbed soil in the pit dug for the interment will differ in color or texture from that surrounding it. Thus the top of the pit is easily determined and, incidentally, the surface of the ground at the time of burial.

Because of the danger when excavating of destroying evidence of days gone, archeologists have long been reluctant to use anything bigger than a pick or shovel, which are generally depended upon for "rough" work. For many years, however, heavy overburden was often removed from sites with horse-drawn slips and Fresno scrapers. But diggers have had to cast about for other means of clearing away sterile soil, and since World War II there has been a tendency to take advantage of modern earth-moving equipment.

On the Missouri and other river systems throughout the United States have been and are being built or contemplated big dams to control floodwaters and to produce electric power. The reservoirs created have inundated great stretches of lowland with hundreds of important archeological sites. To make matters worse, the sequence of prehistoric cultures in the Missouri Valley is little known, and a distressingly large amount of information has been lost. To prevent further destruction of evidence relating to the peoples who lived in America in pre-Columbian times, Congress, in 1946, authorized the River Basin Archeological Salvage Program by means of which the Federal Government, through the Smithsonian Institution and the National Park Service, entered into coöperative agreements with various state agencies (chiefly state universities) in an attempt to save as much material as possible before work on such construction projects is undertaken.

To explore all the sites involved would take the concentrated efforts of most of the nation's archeologists for many years. However, it is necessary only to survey the areas to be flooded to arrive at the number and distribution of prehistoric sites, to do some test digging to determine the depth and nature of the deposits, and to engage in some intensive excavating at a few of the more important points. Even this program, if done with pick, shovel, trowel and brush, would take more time than is normally available. At most, approximately five seasons can be counted on from the date engineers start work on a large dam until water is impounded behind it, and instances are reported of archeologists throwing the last shovelfuls of earth as the slowly rising waters of a reservoir wet their feet.

Under such conditions, speed is essential, but it was not until 1948 that heavy earth-moving equipment was used in the Missouri Basin. The following year the merits of the bulldozer versus the road grader were discussed. It was decided that the lighter patrol grader, which offers the operator excellent visibility, is preferable for large flat areas and for tilled land, but that the bulldozer cannot be beat for removing thickly matted or deep overburden. The former is generally utilized to strip a site, a few inches

DOING IT THE EASY WAY

A blast of compressed air will quickly remove loose dirt from cracks and recesses that can't be reached by a brush. A Navajo Indian, who is plainly more intent on the camera than his work, is shown cleaning the wall of an excavation at the Casa Grande National Monument in Arizona.

at a time, until changes in soil color indicate the presence of ancient house floors, pits or other features of a village. It can do this in a matter of a few hours, whereas it would take weeks to clear away the top soil with hand tools.

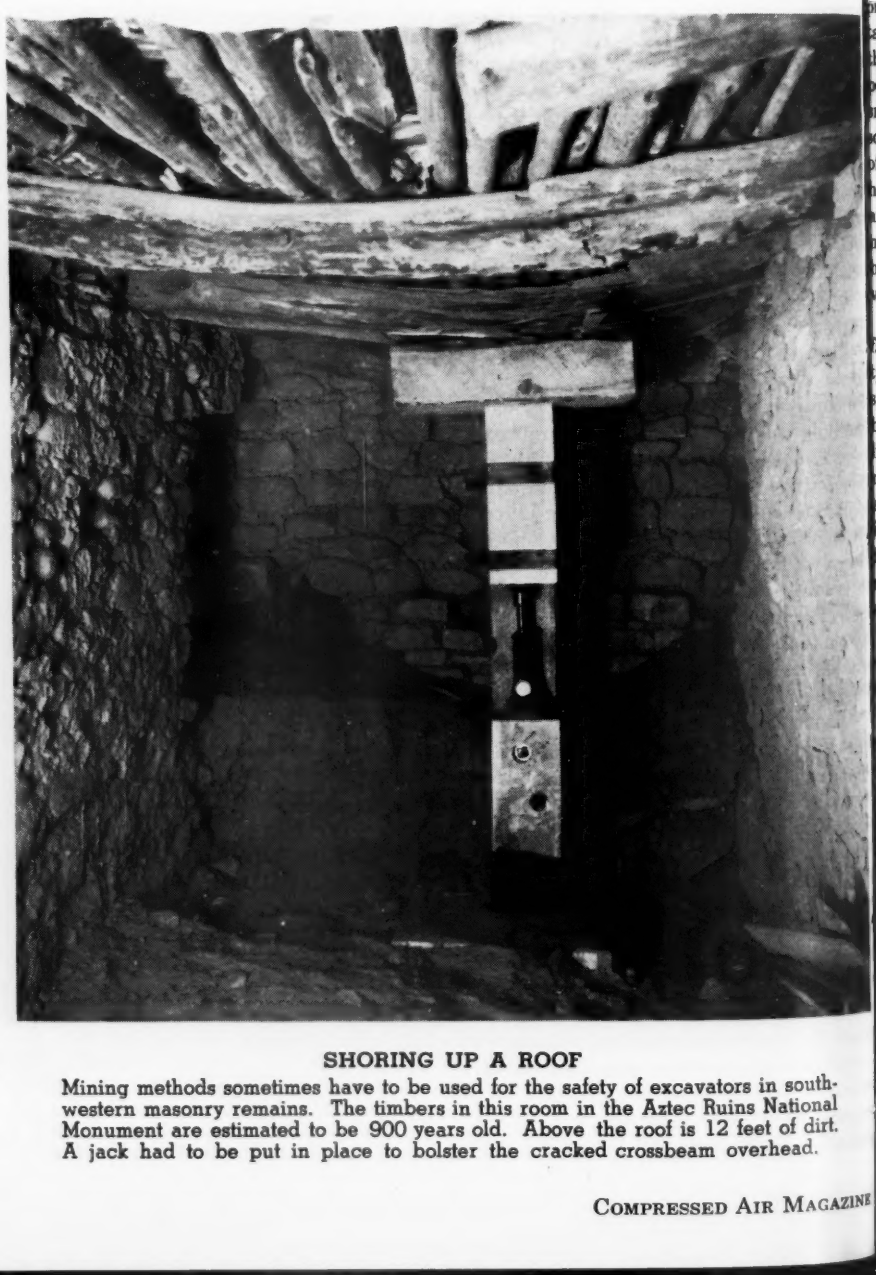
At the present time the International Boundary and Water Commission is building a large irrigation and flood control dam (the Falcon Dam) across the Rio Grande at a point about 75 miles below Laredo, Tex. An archeological survey of the area to be inundated has disclosed a number of "occupational" levels which are buried as much as 32 feet below the present terrace level and in which hearthstones, flint chips and snail shells have been found. (The snail was an important item of food for the Indians of southern and central Texas.) Bones of extinct mammals such as the elephant also have been located in the same horizons, giving rise to the belief that the sites will produce important evidence concerning the life of very early man in America. As a result, the University of Texas, the Smithsonian Institution and the National Park Service, together, have made plans to explore the Falcon Reservoir area in order to gather as much information as possible before it is flooded.

With the meager funds available, it would be too slow and costly to remove the overburden with hand tools. The procedure on the Falcon project, and with slight variations elsewhere where heavy equipment is used, is first to dig a trench with pick and shovel. To one face of the trench are then nailed paper targets, which are aligned with a level and set at a height above the occupational level equivalent to the height of the dozer blade, plus 6 inches. Using the targets as a guide, the operator can then easily clear away the ground to a point only a few inches above the horizon to be worked. The 6-inch padding below the tractor treads is sufficient to protect the site itself from serious damage and is removed with hand tools.

Compressed air has long been an aid in recovering prehistoric remains, in fact, antedates mechanized equipment in this field because an archeologist, after carefully brushing off a piece of pottery, vessel, bone or stone implement he has dug up, instinctively puckers up his lips and gently blows off any remaining dust so the specimen will be clean for making drawings and photographs. Air blowers are virtually a necessity in excavating some cave sites. Often large with small openings through which little if any air can enter, groups of men working in such confined places without artificial means of ventilation would be in danger of asphyxiation. European archeologists have explored many ancient caverns, especially in southern France and Spain, and seem to have been the first to use blowers.

An excellent example of an undertaking of this kind is a cave a few miles east of Capitan, N. Mex., which, so far as can be determined at present, was occupied by Indians for at least a couple of hundred years sometime between a thousand and fifteen-hundred years ago. The site was excavated during the summers of 1950 and 1951 by student labor under the supervision of Dr. Paul Reiter of the University of New Mexico. The mouth is about 4 feet wide and has a maximum height of 2½ feet. The cave proper, an irregular oval room some 200 feet long, 50 feet wide and 40 feet deep, is reached by crawling down a tunnel around 20 feet long. The floor was covered to a depth of about 15 feet with fill consisting largely of dirt and trash left by the Indians.

Though the back of the cave is moist from seepage, most of the fill was what is called "bone dry." Even wearing goggles and respirators, the men required a dependable supply of fresh air to do their work. After a portable, gasoline-engine driven electric generator had been installed outside and lights strung inside, a blower was set up at the tunnel entrance and a 10-inch duct extended to the rear of the chamber so the air would be forced through the cave and out by way of the tunnel, carrying with it most



SHORING UP A ROOF

Mining methods sometimes have to be used for the safety of excavators in southwestern masonry remains. The timbers in this room in the Aztec Ruins National Monument are estimated to be 900 years old. Above the roof is 12 feet of dirt. A jack had to be put in place to bolster the cracked crossbeam overhead.

f the dust raised. With a short field ession (usually four to twelve weeks uring the summer) and a shorter bud- et, the method, though not entirely atisfactory, is the one most commonly sed in cases of this kind.

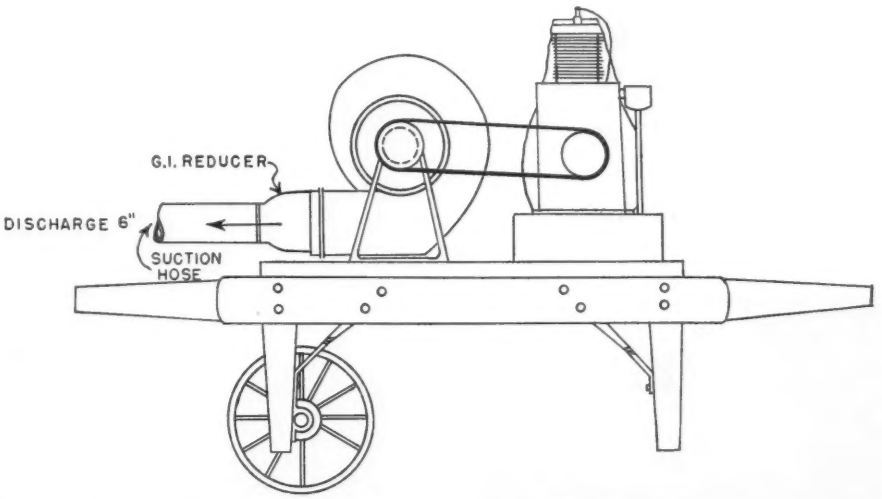
During the 1930's, Dr. Victor Smith, f Sul Ross College, Alpine, Tex., was ngaged in digging a series of caves in the lpine-Big Bend region of Texas. For hose sites, which were similar to that at apitan, he built a "dust machine" that erved him for years. Using a gasoline- ngine powered centrifugal fan and a lexible pipe, he removed the dust from he working area by suction and spewed t out on a hillside far from the cavern mouth. The equipment proved so satis- factory that the University of New Mexico borrowed it for excavating the Sandia Cave which produced evidence of what is believed to be the oldest man so far discovered in America. (COMPRESSED AIR MAGAZINE, MARCH, 1942.)

One innovation of World War II was he aerosol bomb that was designed to pray insect repellent into the air. Now many other products are packed under pressure into these handy little con- ainers, and among them is a fixative hat is used primarily by artists to "fix" encil and charcoal drawings to prevent mudging. Archeologists are finding the olution very helpful because objects are ften so fragile that they are damaged if handled in the condition in which they re found. With the bomb, it is an easy matter to protect them against breakage y applying a coat of the tough preser- vative.

Another tool that is beginning to win favor is the "one-lung" compressor, the ype that supplies air for small paint- spray guns with long flexible tubing. A last of air at 20 to 25 psi pressure, de- ivered through a ¼-inch tube without a nozzle, is frequently more effective than a trowel and brush in cleaning or remov- ng the final layer of dirt from prehistoric house remains and utensils. It is also much easier to follow a cleavage plane in soil with an air hose than with a trowel. The method serves best in light to mod- erately light soils and must be used in the open.

Other labor-saving devices such as an endless belt to carry excavated material to a dump have been suggested, and while they would undoubtedly be useful, cost of rental, installation and operation would be prohibitive. Even road graders and dozers cannot be utilized unless the equipment is near at hand and available for short periods. All this boils down to the fact that, willing though the arche- ologist is to lighten his labors, the trowel and the brush still are the primary tools of his calling.

This article would not be complete without some mention of the vital part erial photography now plays in map- ping ancient remains. Since 1929, when Lindbergh flew over the Yucatan jungles to locate Mayan sites, this method of surveying has become standard practice throughout the world. It is of inesti- mable value on jobs like the River Basin Surveys, where time is of the essence, because much more can be seen from the air than on the ground and weari- some, time-consuming footwork is well- nigh eliminated.



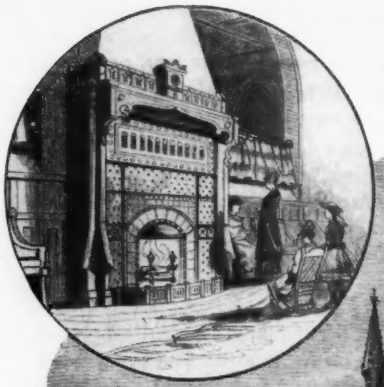
WHERE EARLY INHABITANTS LIVED

This cave in the Davis Mountains of southwestern Texas yielded important infor- mation about prehistoric dwellers in this general area. To remove dust stirred up by the workers it was necessary to rig up an exhaust system with some flexi- ble ducts and a blower driven by a gasoline engine. So that the machine could be pushed around, it was mounted on a simple carriage, as sketched at the top.

BROAD STREET STATION PASSES

Wreckers Have Hands Full with Old Philadelphia Terminal and Chinese Wall Approach

C. H. Vivian



BETTMANN ARCHIVE

PENNSYLVANIA RAILROAD PHOTO

SAW IT OPEN AND CLOSE

Mrs. Henry P. Baily poses with President Walter S. Franklin of the Pennsylvania Railroad on the rear platform of the last train out of Broad Street Station. As a girl of thirteen she was in the station the day it went into service seventy-one years previously.

ORIGINAL STATION

The 4-story structure as an artist depicted it in the "Scientific American" of May 12, 1883. The lower building at the right, which was subsequently demolished to make an addition to the station, was the first freight depot. Note the covered wagons backed up to it. Fifteenth Street ran through a tunnel between the two structures. Stretching off to the right is the elevated approach supported by a series of brick arches. The inset at the upper-left shows the fireplace in the main waiting room on the second floor where a wood fire burned in cold weather. On the surrounding tiles were scenes from Scott's Waverly novels and also representations of mythological characters. The other inset shows the grand stairway, a structure of solid marble that was hailed as the height of elegance when the station was new.

DOWNTOWN Philadelphia is being denuded of two of its best-known and time-worn structures —Broad Street Station and the story-high vaulted brick support for the Pennsylvania Railroad tracks running into it. In its heyday the depot was acclaimed the world's largest and finest, and parting with it has aroused "sweet sorrow," to borrow words from Shakespeare. The passing of the ugly elevated railroad, on the other hand, occasions no sorrow, sweet or bitter. Philadelphians of two generations have attacked the unsightly obstruction with barbed criticism, and years ago summed up their feelings by dubbing it the "Chinese Wall."

Once, however, the station was indispensable and the city's pride. When it was at its zenith, almost 70 years ago, there were months when it handled a million passengers. Many of the world's notables and celebrities detrained there and walked down the wide marble stairway to the street. Among them was every president since Chester A. Arthur (President Eisenhower used the station while in the Army), as well as the Prince of Wales, King Albert of the Belgians, and stars of stage and sports. Even Man o' War, peerless race horse, once arrived there in a special car.

Demolition of the depot and approach is part of a central-city improvement program which was launched a full 28 years ago but which meanwhile ran into various snags. Their removal will clear 22 acres of land, valued at $12 million, for development according to modern municipal ideas of utility and beautifi-

PENNSYLVANIA RAILROAD PHOTO

AS ENLARGED IN 1893

This picture of the station, dated by the Model T Fords and the horse-drawn vehicles, was taken from the steps of City Hall and plainly shows its numerous architectural embellishments as well as the peristyle above the sidewalk. The latter helped to protect pedestrians when the building was razed. The station was designed by Frank Furness, considered the nation's first "modernist" architect.

cation. It rarely happens that a plot of that size becomes available for reconstruction in the heart of a city as large as Philadelphia.

The structures were built in 1880 and 1881 at an initial cost of $4,272,000. Most of the urban population then lived and worked in the V formed by the junction of the Delaware and Schuylkill rivers, but the closest railroad depot was on the western fringe of the city across the Schuylkill at Thirtieth Street and on the site of the present main Pennsylvania terminal. It must be borne in mind that horsecars were then the nearest approach to rapid transit. In fact, it was not until 1883 that the railroad company inaugurated hansom-cab service to and from the stations. An article in the *Scientific American* in May of that year hailed the conveyance as a "novel feature," mentioning that "these peculiar vehicles are made by Hincks and Johnson in Bridgeport, Connecticut," and adding that "we understand they are now being introduced in Washington and other cities."

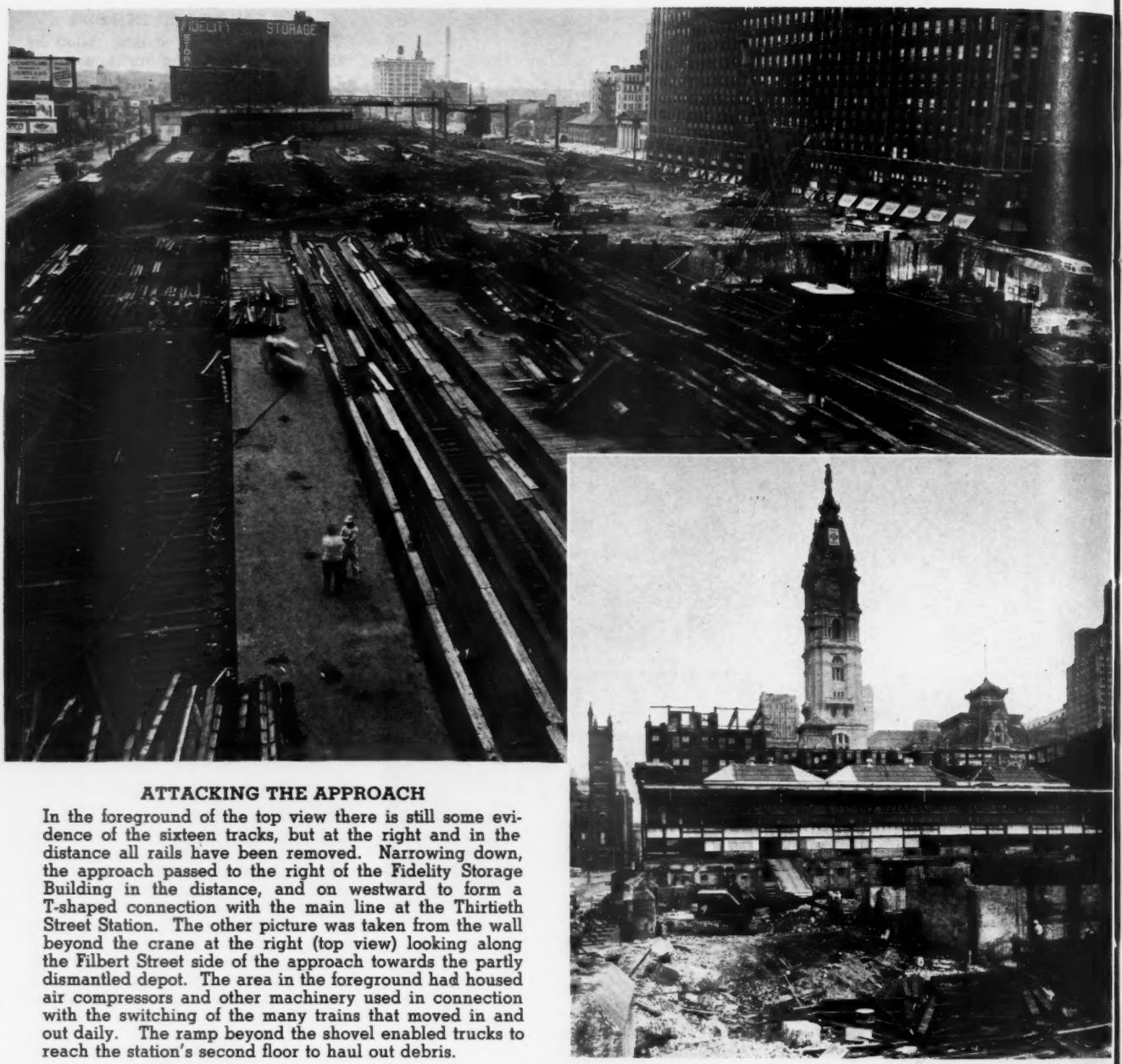
City Hall, located athwart the intersection of Broad and Market streets,

ARCHED APPROACH

A view around Eighteenth Street during the early dismantling stages showing the brick-arch construction of the "Chinese Wall" that carried the tracks for 70 years. There were 60 arches of 24- and 26-foot span except at street crossings, where they measured 50 feet.

NETWORK OF TRACKS

Angular view across Market Street showing how tracks fanned out sixteen wide as they neared the station.



ATTACKING THE APPROACH

In the foreground of the top view there is still some evidence of the sixteen tracks, but at the right and in the distance all rails have been removed. Narrowing down, the approach passed to the right of the Fidelity Storage Building in the distance, and on westward to form a T-shaped connection with the main line at the Thirtieth Street Station. The other picture was taken from the wall beyond the crane at the right (top view) looking along the Filbert Street side of the approach towards the partly dismantled depot. The area in the foreground had housed air compressors and other machinery used in connection with the switching of the many trains that moved in and out daily. The ramp beyond the shovel enabled trucks to reach the station's second floor to haul out debris.

had then been under construction for ten years and was the hub of official and commercial life. So as to land passengers as close as possible to this central point, the new depot was erected just across the street from it. The original structure was four stories high. The approach from the West Philadelphia Station at first carried eight tracks, and its final 6-block stretch from Twentieth Street to the Broad Street Station was in the form of an iron-and-steel viaduct.

The depot was opened on December 5, 1881, and the first timetable shows 80 trains arriving and leaving daily. Traffic grew steadily, and the number of tracks was increased to twelve in 1890 and to sixteen in 1894. To make the skeleton viaduct section more solid and to lessen the noise of the trains it was replaced by a red-brick structure built in a series of arches and about 20 feet high. This gave the final blocks of the approach an over-all width of 300 feet so that the latter occupied the entire block between Market and Filbert streets. Beyond Eighteenth Street it was narrower. Eight of the arches had a span of 24 feet, 48 were 26 feet wide and four, over cross streets, 50 feet.

Originally all the archways were open, but those near the station were later bricked up to form solid walls and thus provide spaces for freight and express offices and to house mechanical equipment necessary to operate the line. In the latter category were two large Ingersoll-Rand compressors that supplied air power for setting signals and switches that controlled the flow of traffic over the maze of tracks. The compressors were removed before demolition was begun, but some of the offices remained in use until the approach of the wreckers compelled them to vacate.

In 1893 more ground was acquired and the depot was enlarged. The new section rose to a height of ten stories with a surmounting Tudor tower, and the upper part was occupied in 1894 by the general offices of the Pennsylvania, which had been located elsewhere. During that period a glass, arched train shed 306 feet wide, 591 feet long and 100 feet high at the crown was erected over all sixteen tracks. Around 450 trains were then arriving and departing daily.

The waiting room and dining room, the latter with a seating capacity of 500, were on the second floor and on the same level as the tracks. Ticket offices and other facilities for serving passengers were on the first floor. Both were artistically finished. Left to the wreckers was one of the largest pieces of terra-cotta ever fired—a panel portraying "Transportation and the Progress of Transportation," which the Austrian sculptor Karl Bitter had executed shortly after the enlarged station was opened 59 years ago. Another of Bitter's works, a plaque depicting "The Spirit of Trans-

portation," was originally in the main waiting room but was removed in 1933 to the new depot at Thirtieth Street.

Beginning around 1900, the railroad company had bought some land north of the approach, just across Filbert Street, with the idea of running in more tracks, but that never came to pass. Gradually gathering force was a vigorous campaign to do away with the station and approach. The burning of the magnificent train shed on June 11, 1923, added impetus to the movement. The shed was never rebuilt, and it was known then that Broad Street Station was doomed, although many more years were to elapse before it was torn down. As far back as 1903, trains bound to and from New York were being routed through the city without going into Broad Street. The rise of the automobile and other means of rapid transportation eliminated the need of bringing all passengers into the center of town. For the benefit of commuters and others who desired to end or start trips there, an underground railway was envisioned.

The furore finally led to the signing of an agreement on July 13, 1925, which bound the railroad company and the city to carry out jointly a long-range program of civic improvement and modernization. The Pennsylvania pledged itself to construct a new underground Broad Street Suburban Station on the land it had acquired across Filbert Street and to bring subsurface electric lines into it. As a preliminary to that step some of the suburban lines that would feed most of the traffic into the new station had to be electrified. After these things had been done, the road was to remove all surface tracks leading into Broad Street. The city agreed to put the Market Street elevated railroad underground, to build additional streets near the terminal west of the Schuylkill and to widen Filbert Street, change its name to Pennsylvania Boulevard and extend it westward from its existing dead end at Eighteenth Street, with a bridge across the Schuylkill. That would involve the acquisition of some property and the construction or shifting of some water and sewer lines.

A start was made in 1927, and by 1933, when the depression suspended activities, the railroad had spent $68 million and was operating its Thirtieth Street and suburban stations and underground connecting lines. Then came the war years, when little could be accomplished. But on November 11, 1946, the parties concerned met again and agreed to resume work, which they did in 1948. In bringing about changes incidental to fulfilling its promises, the railroad has laid out $83 million, according to its executive vice-president James M. Symes, and will have to spend $12 million more. Additions at the Thirtieth Street Station to better fit it for service have cost $9 million in recent years alone, he reported. The city has made outlays totaling $25 million, and is prepared to make more. Its burden will be lightened somewhat, however, through an agreement whereby the state will extend the new Pennsylvania Boulevard to be fashioned from Filbert Street.

Like a condemed man who gets anything he wants for his final meal, old Broad Street Station was given a "party" before being abandoned to its destroyers. The last scheduled train, No. 431 for Washington, pulled out at 1:10 on the morning of April 27, but as a parting gesture a special was arranged for departure that night and the public was invited to turn out to offer its farewells. It speaks well for the sentimentalism of Philadelphians that more than 5000 braved a pouring rain to do so.

DRILLING ON OVERPASS

Sixteenth Street, left, with part of its brick arch removed. Close to the left-hand edge are seen two rows of holes that have been drilled in one of the stone walls supporting the archway. They are plugged preparatory to loading with powder. They were drilled, as shown above, with an Ingersoll-Rand drifter mounted on a pneumatic-tired carriage to facilitate moving.

TEDIOUS TASK

A paving-breaker operator and helper gouging out brickwork encasing a steel column in the process of demolishing the masonry from the top downward. On the far side of the men is a sheer drop of five stories. At the left rises the tower of City Hall surmounted by a figure of William Penn. The latter is of such proportions that the nose is 15 inches long and the waist has a girth of 26 feet.

Officials of the Pennsylvania Railroad and the municipality were on hand, and there was some speechmaking. The train was to carry the Philadelphia Orchestra on the first leg of its last road trip of the season, marking the 885th departure of the organization from the station. In full strength the group, directed by Eugene Ormandy, played piece after piece, and Mr. Ormandy paid the huge structure the compliment of saying its acoustics were good enough for a concert hall. The crowd bought 4384 souvenir tickets as mementos, and close to 700 persons were able to get aboard the train to ride as far as the main terminal or the North Philadelphia Station.

At 9:57 on the dot, the engineer got the signal to pull out, and the train moved off very slowly with five members of the orchestra on the rear platform accompanying the assemblage as it sang "Auld Lang Syne." On the following morning, in the almost deserted building, Mayor Joseph S. Clark, Jr., and M. H. McCloskey, head of the company that had contracted to reduce the edifice to rubble, officially set razing in motion by jointly barring down some once-prized interior ornamental stonework, while cameramen recorded the scene. It was the most important wrecking job Mr. McCloskey had ever undertaken. Most of his undertakings call for building things, and they are often of considerable size.

The demolition job being carried out by McCloskey & Company is a tedious one because of the location. Put the same structures in an outlying district and let the contractor topple them with dynamite as he might please and the site would have been cleared months ago. But because of their situation at the crossroads of a city of nearly two million people, it has been impossible to close off streets, and so far the work has been done without so much as dropping a brick outside the boundaries of the structures. The station was literally picked to pieces from the top downward. As it was torn apart, brick, stone and steel were dropped or chuted inside to the first or second floors and trucked away.

With explosives banned, the most effective tools were air-operated paving breakers and oxyacetylene cutting torches. Upwards of 30 breakers were brought to bear, 21 of them Ingersoll-Rand PB-8 models. Portable compressors that supplied them with air were located on the ground, and a profusion of hose lines was run up stairways and elevator shafts. The workmen soon found out that they were not playing with cream-puff construction.

The terminal had been put together stoutly and might easily have lasted out the century or longer without crumbling had it been left unmolested. Exterior stone and brick walls were backed up heavily with red-brick courses, the whole knit together with time-resisting mortar. Interior walls were mostly of brick alone, but thick enough to give trouble. In many places rope slings were arranged to support a paving breaker in a horizontal position, with one man operating it and a partner removing dislodged masonry with a prying bar. After inside walls had been cut free at the ends, they were often pushed over with improvised battering rams and then broken up into chunks that could be readily handled.

The skeleton of the station was composed of approximately 4500 tons of steel of the Bessemer variety. It was thicker in section than that now used for the

same purpose and therefore took longer to cut with torches. No effort was made to salvage the steel, but many of the bricks were taken to a cleaning site to be restored to usefulness. For the most part, however, stone, bricks, mortar and miscellaneous debris were trucked off for disposal in areas that needed fill. The average round trip required an hour.

Out on the approach wall the contractor has also met some surprises. No estimate had been made of the steel it embodies, but a great many girders have been found in places where they were not expected. Near the depot, where the arches had been closed, the interior of the structure, as already mentioned, was honeycombed with brick-walled rooms occupied by clerical staffs or machinery. On top of the approach had been laid steel members to support the track. Spaces between girders had been backfilled with earth, which the wreckers are moving effectively with bulldozers to points where it can be conveniently loaded into trucks by power shovels. An American crane with a 70-foot boom lifts out steel sections and other heavy members as they are broken loose.

Most obstinate of all are the arch structures at street underpasses. There cross thoroughfares, slightly depressed, go through tunnels 300 feet in length. The arches of brick vary in thickness from 4 feet at the crown to 8 feet at the sides, and the heavy masonry abutments, usually 18½ feet thick, rise from 18 to 20 feet above street level. Built of granite, quartzite and sandstone blocks, they rest on piers of concrete extending into the ground as much as 30 feet in places.

TEARING OUT A VAULT

Paving-breaker crew attacking the heavy brick wall of a vault on the fourth floor where records were kept. Rubble was wheeled in barrows to chutes leading down to truck-loading stations on the second floor.

As all these streets carry heavy traffic, every effort has been made to obstruct them for as brief a period as possible. This was especially true at Sixteenth Street on which trolley cars run, as the traction company's bill for stoppage of service was $1500 a week. Because of the type of construction involved, it was necessary to resort to blasting, but by drilling and loading a large number of holes in a block the number of detonations was reduced to a minimum. In the brick arch, holes extended almost but not quite through the structure, while those in the stone abutments were drilled 10-12 feet deep on 5-foot centers and in two rows 6 feet apart, with the outer ones 6 feet from the edge. Drilling was done with wagon-mounted drifters using Ingersoll-Rand Jackbits on 1¼-inch hollow, round steel. Starting bits were of 2⅞- or 2¾-inch gauge, and the deeper holes were bottomed at approximately 2-inch diameter.

The first blast, which was designed more or less to test the effectiveness of the shooting plan, was set off in the predawn hours of Sunday, October 27. One result was more than 200 telephone calls from hotel guests and others in the vicinity asking if there had been a disaster of some sort. In all, seven shots were fired to break down the first arch, and this served to develop a technique that was followed in razing the others. Prior to each blast, the street underneath is covered with 12x12-inch timbers to protect it, and heavy mats are laid over the section to be demolished to prevent fragments from flying.

As a measure of the volume and character of the operations, it should be men-

PHOTO FROM "THE BULLETIN," PHILADELPHIA

A FALLEN ARCH

View of Sixteenth Street with a part of the overhead arch blasted down. An American crane has a sling around a massive masonry block to lift and load it into a truck. Three paving-breaker operators are working on the muck pile reducing large pieces to sizes that a power shovel can handle.

PENNSYLVANIA RAILROAD PHOTO

AREA BEING CLEARED

Print of aerial shot, looking westward, on which have been blanked out the sections which will be available for development after clearing operations are completed. In the foreground is the tower of City Hall.

tioned that a force of up to 235 men has been on the job steadily since last April and has only recently reduced the station and four blocks of the elevated structure to ground level. The crews are now working west of Eighteenth Street. In addition to wrecking, the McCloskey contract calls for excavating and setting steel in an underground passageway wide enough to carry three additional tracks into the Suburban Station. Only one track will be laid now, the others are to follow when needed.

It has not been decided just what will be erected on the cleared land. The most recent proposal put forward by Robert W. Dowling, president of the City Investing Company in New York, calls for a business, shopping and hotel district similar to Rockefeller Center in that metropolis. Six buildings, 25 to 30 stories high, would surround an esplanade. One structure would provide parking room for 1500 motor cars. The cost of the project is estimated at from $75 million to $100 million.

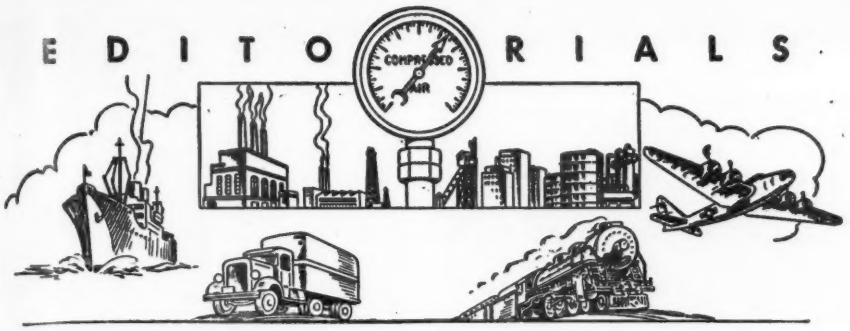
Some adherents of the modernization program favor tearing down City Hall and including the site in the improvement scheme. This would open up both Broad and Market streets, and eliminate skirting the 4-block plot on which the edifice stands. Should their ideas prevail, which is doubtful, a wrecking job of huge proportions would result. In their zeal to change the city's face, members of the anti-Hall faction have attacked the building as a monstrosity.

On the other hand, Dr. Robert C. Smith, an authority on such matters, terms it "a remarkable representation of 16th century French Renaissance architecture." And City Architect George L. Lovatt, Jr., thinks that if the building were in Paris Americans would probably rave about it and even pay for the privilege of going through it.

Its removal was first advocated many years ago by Paul P. Cret, architect and University of Pennsylvania professor. More recently, however, stout defenders of the old Hall have appeared. It is, in fact, a remarkable structure in several ways. It is larger than the capitol in Washington, only 7½ feet shorter than Washington Monument and contains 622 rooms. The walls of its 100-foot-square tower are 22 feet thick at the base, to mention one eyebrow-lifting statistic concerning the solidity of its construction. The building was started in 1872, not completed until 1907 and cost $24,344,355. After mulling over the pros and cons of its right to existence, Sidney G. Hantman concluded a recent article in the *Philadelphia Inquirer Magazine* with this prediction:

"Despite all the controversy, it is safe to assume City Hall will stand for a long time where William Penn wanted it. The very task of razing the building perhaps would take years. Last year workmen shaved 20 feet of the granite curbing to make a driveway for official cars at the northeast corner of the Hall. Working with pneumatic hammers and drills, sledges and picks, it took two to six men all of six days to do that job."

Anyway, the staid old object of the argument is going to look a little different now that its smaller but almost equally tough neighbor has departed.



THE ENLARGING CIRCLE

IN A SERIES of articles on Canadian mining history that appeared in these pages in 1935 and later, R. C. Rowe likened the discovery of ore at Cobalt, Ont., in 1903 to the casting of a pebble into a pool of still water. Just as the pebble causes ripples that go out in ever-widening circles, so did the men who were trained at Cobalt and the money that was made there radiate to other sections of the country and open up more mines. And, in a sense, the pattern still persists. In Canada, as elsewhere, riches taken from the ground seem to have a way of going back for more.

Take the case of the Steep Rock iron mine. It comes to mind now because of the news that the Inland Steel Company, a United States concern, has taken a 99-year lease on 1200 acres of Steep Rock deposits and thus insured itself an ore supply for a long time to come. Steep Rock was started on its way to production with money obtained from gold mining. The iron was there all the while, but it took the venturesome spirit and curiosity of a gold miner to go after it seriously.

Steep Rock is a monument to the acumen and persistence of the late Joseph Errington, who had successfully promoted the Little Long Lac, MacLeod-Cockshutt and Negus mines, all gold producers. To understand the situation, let us go back a few decades. Iron has never had the allure of gold for prospectors, but the Canadian Government recognized long ago that it is the foundation of industry.

As far back as 1883, the Dominion offered a bounty of $1.50 a ton for pig iron made from domestic ores, but little money was called for. Later the offer was extended to cover the proportion of Canadian-mined ore used in conjunction with ore from the United States. Subsequently the Province of Ontario volunteered to pay a bounty of $1 a ton and, as recently as 1937, its legislature sought in the same manner to stimulate the search for commercial ferrous deposits. There was little response, although prospectors continued to look for and find gold despite the deterioration of its once enviable position as a symbol of opulence.

Meanwhile, Canada had lots of iron ore, but it was as yet undiscovered, and our northern neighbor was getting virtually the entire supply for its steel mills and foundries from our sources of supply. Ironically, ore had been reported in the Steep Rock area in 1897, but nobody investigated. And in 1905, H. L. Smyth, a member of the Harvard University geological staff, did some work there and predicted that extensive deposits would be found. Still nothing was done. Finally, in 1938, Julian C. Cross, a Port Arthur geologist, went over the ground and reiterated previously expressed opinions. But there was no rush of prospectors; in fact, not one went near the place. They simply were not "iron-minded."

Eventually, Errington and some of his associates in previous ventures, including D. M. Hogarth, put up the money to prove or disprove the presence of ore by means of diamond drilling. No one paid any attention to them, and the holes that gave evidence of deposits were drilled in ground they had not staked. They filed on it later, at their leisure.

Following this favorable prospecting, the men formed a company and began the gigantic task of diverting a river and pumping a lake dry to give access to the ore bodies underneath. Fourteen pumps, each driven by a 500-hp motor, reduced the level 7 inches a day by lifting two million tons of water every 24 hours—half enough to supply New York City. The shallowest deposit was 70 feet below the surface, and after the water was disposed of it was necessary to remove thousands of tons of silt. Mining got underway in 1945, and the output has been increasing steadily. The price of iron also has been rising, and it is interesting to note that ore from Steep Rock now brings more per ton than did the gold ore at Little Long Lac.

Thus we find the ripples still moving outward from Cobalt. We also find the once iron-rich United States going across the northern border for ore to keep its steelmaking juggernaut running at full speed. Curiously, Inland can get its supply cheaper from Steep Rock than from our own Great Lakes ranges. Port Arthur, where the ore is loaded into Lake Superior boats, is 120 miles closer to Inland's Steel plant at Indiana Harbor (near Chicago) than is Superior, Wis., loading point for ore from the Mesabi Range.

We find, too, that money earned in gold mining is helping to develop another Canadian source of iron ore—Labrador. American and Canadian interests are putting millions into the venture. The Canadian funds come from the Hollinger, the Dominion's leading gold mine, located by ex-blacksmith Benny Hollinger.

WHAT MATERIAL?

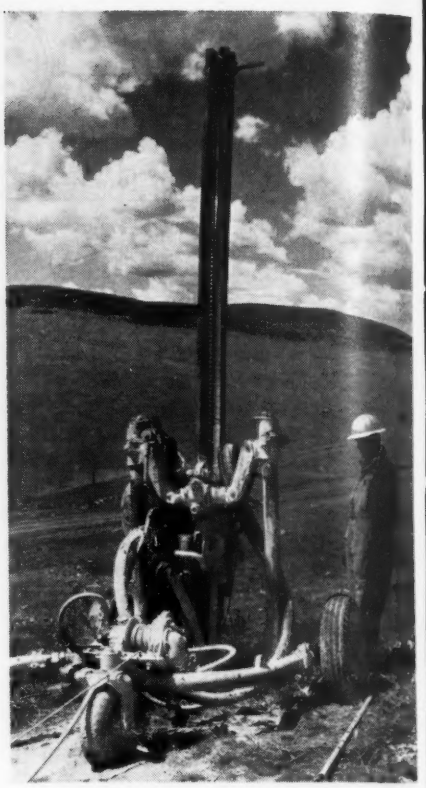
CHOOSING the right material for industrial machines or processes is not as easy as it sounds, and it is getting more complicated all the while. There are now more than 25,000 materials to pick from, and the list is rapidly growing longer. In the field of metals, alone, there are 15,000 known alloys. The rise of plastics has brought a new flood of materials, and modern ways of treating wood have made lumber more adaptable than ever before.

Suppose you are going to make "widgets" and you have tentatively selected the material for their outer case. To judge whether it is "best" for the purpose involves the consideration of many things. Some of the questions that will arise are: Will it do the job assigned to it? How does it compare in cost with competitive materials? Is it readily available now and will it continue to be if a national emergency should arise? Will it give your widgets sales appeal? Can it be processed economically with your machinery? After weighing these and many other factors for a few days or weeks, you will perhaps end up rather confused. And, if your widgets must withstand high or low temperatures or varying humidities in world-wide trade, your headache will grow worse.

This problem of choosing what to use in manufacturing hard goods has become so pressing that it is to be given special attention. In New York, in June, there is to be a 3-day discussion of all its phases by experts from leading industrial concerns. The general aspects of materials selection will be taken up during the morning sessions, and the afternoons will be given over to technical and engineering considerations of the properties of new and old materials.

Supplementing the program will be a 5-day display of hundreds of different materials, with well-versed attendants on hand to explain their merits for various applications. The whole presentation is to be called the Exposition of Basic Materials for Industry. Heads of twenty leading manufacturing companies are on the sponsoring board. This promises to be one "show" that should be worth the effort spent in arranging it and the cost involved. It is predicted that 15,000 interested engineers and production men will attend.

Union Pacific Changes 42 Miles of Line



STARTING THE ATTACK

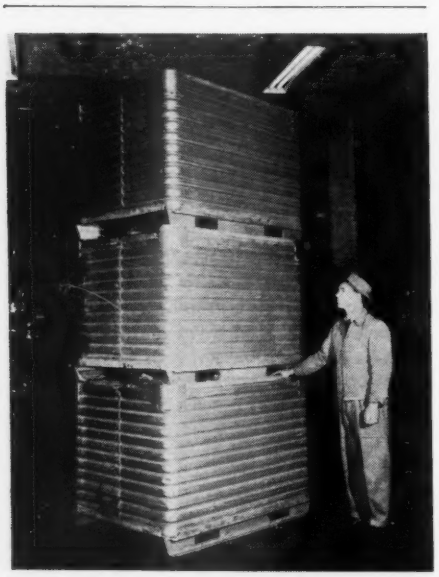
Shown are Ingersoll-Rand wagon drills and portable air compressors beginning work on one of the rock cuts. Equipment of this type was much used in drilling blast holes for the removal of 2.4 million cubic yards of rock.

ONE of the largest railroad construction jobs carried out in the country in recent years was completed on the Union Pacific System in February by Morrison-Knudsen Company, Inc., of Boise, Idaho. It involved grading a new 42-mile link between Cheyenne and Dale Creek, Wyo., to reduce the grade up the western slope of Sherman Hill from 1.55 percent to 0.82 percent. The new route is 9 miles longer than the old one, but will save up to fifteen minutes in the running time of climbing westbound trains. Eastbound trains will continue to descend via the original shorter line. In crossing Sherman Hill, the Union Pacific tracks reach an elevation of 8014 feet, the highest on the system.

Morrison-Knudsen forces began work in February, 1952, with an 18-month deadline, but good organization of the job, modern equipment and favorable winter weather enabled them to finish in a year, even. In that period they drilled, blasted and moved 2,400,000 cubic yards of rock and excavated and shifted 4,600,000 cubic yards of earth. With up to 600 men working in eight groups, they handled as high as a million cubic yards of material a month during the peak of operations.

To establish grade, it was necessary to make 118 major cuts and 111 major fills. The largest cut is a 165-foot-deep gash in solid granite near the Dale Creek end of the job from which 398,000 cubic yards was removed, hauled four miles and deposited in a 164-foot fill at Tex Creek that contains 750,000 cubic yards of material. Under a separate contract the same firm placed drainage structures, including 500 culverts ranging in diameter from 18 inches to 15 feet.

Union Pacific track-laying crews kept pace with the grading gangs, and the rails were in place throughout the new stretch of line in a matter of hours after the last dirt had been moved. The change cost the Union Pacific about $17 million and is the most extensive one made on the line since it became the first transcontinental railroad with the driving of the famous golden spike at Promontory Point, Utah, in 1869.



LIGHT BUT STRONG

The tote boxes shown here are made of aluminum and were designed by the Aluminum Company of America for handling scrap and finished products. Each is 60x42x36 inches in size, will carry a 500-pound load and weighs only 245 pounds as compared with the 620 pounds of a comparable steel container. They are mounted on low runners and provided with lugs to facilitate lifting and stacking by fork truck and dumping. Five hundred are in use in Alcoa's Cleveland, Ohio, plant.

Air Power Keeps Firm Competitive

THE magazine *Steel* reports that Aero Fastener Corporation, of Burbank, Calif., which makes screws, rivets and fittings for the airplane industry, is able to hold its own in competition with larger concerns through savings effected with air power. When drilling metal, for instance, it utilizes air-operated vises, usually on drill presses, to hold the work. Instead of actuating a vise with the usual pedal, it is arranged to close when the press spindle descends and to open when the spindle is raised. After this technique had been tried out with success, it was decided also to provide the drills with air to produce uniform pressure throughout the feed and to permit adjusting the pressure according to the kind of metal which was being drilled.

On a screw-heading machine pieces are ejected by a jet of air. Precision grinding of some surfaces is done by an air-powered device attached to a lathe. The grinder operates at speeds up to 60,000 rpm, and the use of more costly special equipment has been discontinued. Adoption of air chucks on lathes and other machine tools has reduced loading and unloading time, which is especially important because most of the operations are of short duration. Definite figures as to the over-all benefits are difficult to compute, but D. C. Whitehead, a partner in the firm, estimates that air power has increased production about 25 percent.

This and That

"Now don't give me any trouble. I already had a hard day at the breakfast table."

Great Diamond Hunt

Industrial diamonds are so costly, so scarce and so useful in the automotive industry that the larger factories have set up methods for recovering a good share of the bits broken off or worn away in the course of machining operations. Diamond-pointed cutting tools are used for finishing car parts to ultrafine dimensions and for truing or "dressing" grinding wheels. Many of the latter are, in turn, impregnated with diamond powder or "bort" and are employed for shaping and sharpening tungsten-carbide tools, the hardest man knows how to make. A single car manufacturer may have more than 7000 of the diamond-bearing tools and wheels in service.

Diamond dust worn away in grinding operations is sucked into bags by vacuum attachments on the machines. Sludge from wet-grinding processes is trapped in settling tanks and the diamond particles are extracted from it. One company retrieved 8800 carats of diamond dust and fragments in three years. This is roughly four avordupois pounds, worth $20,000, and represents about 11 percent of the firm's annual diamond requirements.

★ ★ ★

Cook Paid More Than Scientist

Scientists weren't as well paid as cooks a century ago, L. G. Simmons of the U. S. Coast and Geodetic Survey told the American Society of Civil Engineers last month. The 1849 gold rush attracted so many people to the Pacific Coast that the Survey decided to chart the coast and harbors in the interest of safety. George Davidson, an assistant in the organization, arrived in San Francisco in 1850 to direct the work. He received $800 a year and had to pay for his own meals. A cook who was engaged to see that the party ate well commanded $125 a month and his expenses.

★ ★ ★

Famous Mosaics Restored

After more than twenty years of work, ten great religious mosaics in the St. Sophia Museum at Istanbul, Turkey, have been restored to their original tenth and twelfth century condition. Prof. Thomas Whittemore, founder of the Byzantine Institute in Washington, D. C., directed the operations from 1932 until his death in 1950, after which Prof. Paul A. Underwood, an authority on Byzantine art and archeology, took over. The mosaics are made up of about 52,000 fingernail-size fragments of marble, porphyry and glass per square yard. Gold and silver were fused with the glass to help form the pictures and to reflect light without distorting the design. The tiny pieces are embedded in plaster coatings applied to a brick backing.

★ ★ ★

Still Going Down

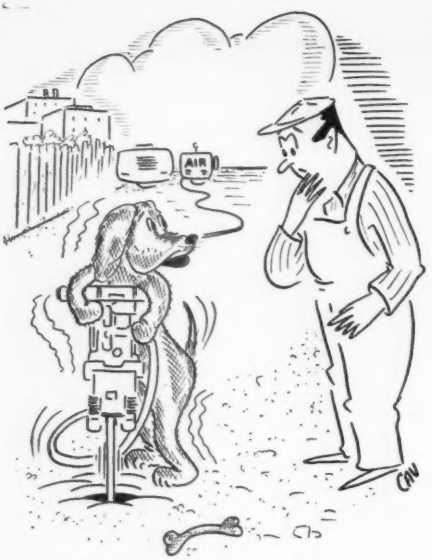
Lake Shore Mine, Canadian gold producer, is holding its place as the deepest mine in the Americas. It will sink its No. 4 internal shaft to approximately 8125 feet vertically below the surface and open mining levels at 7950 and 8075 feet. No. 4 shaft starts at the 5200-foot level.

★ ★ ★

Name Often Printed

Newcomb Carlton, largely responsible for developing the Western Union Telegraph Company into a network of two million miles of wires, died last month. Although known as a modest and retiring individual who shunned public appearances, his name was probably printed more times than that of any other man active over the same span of years. It appeared on every telegraph blank for 29 years, and they were produced by the millions to

"I wish I could tell you what it is, but the President clamped the security lid on all military construction."



"What's so unusual about it? Everybody uses air tools now."

supply company offices, railroad stations, hotel rooms and numerous other public places.

Mr. Carlton started out as a consulting engineer in Buffalo, N. Y. Selected to direct the Pan American Exposition there in 1899, he witnessed the assassination of President William McKinley and helped carry him to an ambulance. After serving with the Bell Telephone Company and Westinghouse, he became a vice-president of Western Union in 1910 and was president four years later. All messages were sent in the Morse code when he came upon the scene, but he introduced typewriter-type senders and receivers and other mechanical facilities. Never an inventor himself, he aided and encouraged many a man who was.

★ ★ ★

Compressed Air Helps Out Steam

Compressed air and steam may occasionally be competitive, but here's an instance where they are partners. At Pass Christian, Miss., Merritt-Chapman & Scott Corporation is precasting concrete piles and floor slabs for a 4-lane, 10,198-foot-long highway bridge it is building across a shallow bay. The slabs are cast in half-width sections that weigh 122 tons apiece. Twenty of them can be produced at a time in a yard 660 feet long. To transfer them to a barge after they are strong enough to be lifted, a gantry crane, running on 50-foot gauge tracks, straddles the yard. Two 2-cylinder steam hoisting engines mounted on top of the gantry drive a common shaft which, through a pinion-gear reduction assembly, drives four hoisting drums each hooked to a 10-foot hoist line.

When in operation, it was found that the racing of the engines to make up for the low gear reduction and the multiple-part lines depleted the boiler's supply of steam before the load was lifted and shifted. Rather than expend the time and money required to increase the boiler capacity, the project manager, Roger Hand, decided to try using compressed air to help out the steam. A line from an Ingersoll-Rand 500-cfm compressor was connected, and when the steam pressure fell below 120 psi the air was turned on. The experiment was successful, and from then on steam and air worked together.

★ ★ ★

Start Was Romantic

Not all the things conceived in hardship belong to a bygone age. The Hagan Corporation, of Pittsburgh, Pa., which makes, among other things, air-operated combustion controls, owes its origin to two men of what C. F. Kettering called "the vanishing breed of attic inventors." They were John Hopwood and Thomas A. Peebles, and their first brainchild, created in an attic, was a device to proportion the fuel, air and water input of an industrial steam boiler in accordance with the demand for steam. That was in 1918.

The concern now has two subsidiaries and seven factories. The aim of another of its early investigations was to get at the truth as to why boiler tubes fail. That was in the era of quack remedies such as oatmeal, wheat chaff and molasses. After four years of study in coöperation with the U. S. Bureau of Mines, Dr. Ralph E. Hall of the Hagan staff came up with "Hagan phosphate," a molecularly dehydrated compound that makes it possible to maintain a chemical equilibrium in the boiler water and thereby control deposition of scale.

★ ★ ★

Like Duz Air Does Everything

Simple ways of solving knotty little problems with jets of compressed air are continually cropping up. At Arner Company, Inc., Buffalo, N. Y., pharmaceutical manufacturer, a carton occasionally went through the packaging conveyor line without receiving its intended contents and caused the firm embarrassment when a customer got an empty. It won't happen again. From random materials—a piece of ⅜-inch pipe, an air-pressure gauge and a regulating petcock—an inanimate pneumatic detective was rigged up to watch the line. Pressure from the plant air line is adjusted so that the force of the jet will blow off an empty carton but have no effect on a filled one.

Textile-industry customers of Rohm & Haas Company complained that a semisolid chemical paste they buy from the firm was difficult to get out of the cylindrical fiber drums in which it is marketed. The problem was solved by boring a ½-inch hole in the bottom of each container and plugging it with a cork prior to filling. Now a drum of paste is tilted, the cork removed, and air at 10 psi pressure directed into the opening from a plant air line. The paste slides gently into the mixing vat.

"I don't know where this sand came from, but all the boys are busy panning it for gold."

Pressure Suit for High Fliers

SPACE SUIT THAT'S REAL

An airman dressed in the Navy's high-altitude pressure suit that carries its own supply of compressed air and oxygen and automatically brings them into play when the external pressure drops unduly, thereby creating an artificial internal atmospheric environment. It will sustain life at an altitude of 100,000 feet and permit the wearer to parachute safely to earth.

NEW attire for the Navy's high-altitude fliers closely resembles popular conceptions of the interplanetary space suit. A pilot wearing it may survive if the cabin of his jet or rocket plane loses pressurization in rarefied atmosphere or if he has to bail out from a great height. It also enables humans to reach altitudes never before attainable.

Unless an artificial atmosphere is created, pure oxygen alone will not keep a person alive at elevations exceeding 50,000 feet. And in the near vacuum above 63,000 feet blood will "boil" at normal body temperature, the body will expand to twice its normal size and death will occur in a few seconds. The plexiglass-helmeted rubber suit automatically inflates whenever the pressure surrounding the wearer drops appreciably and creates an artificial environment for him. It applies counterpressure to the body with compressed air and supercharges the lungs with high-pressure oxygen.

Developed under contract for the Navy by the B. F. Goodrich Company, of Akron, Ohio, the suit is an outgrowth of efforts by the firm's engineers extending over a span of nearly twenty years. They began in 1934 when the late Wiley Post, aviation enthusiast, came to Goodrich with an idea for protective garb to be worn at high altitudes. He wanted something that would withstand internal body pressure in thin air so that he could break the height record held by Lt. Renato Donati of Italy. A year later he wore the suit and with it reached an altitude of 42,000 feet. That garment is believed to represent the first attempt to create an artificial environment for a pilot. It is now in the Smithsonian Institution in Washington, D. C.

Goodrich resumed development work in 1941 at the request of the Air Force, which wanted a suit of that kind because efforts made at the time to pressurize B-17 bombers were not working out as planned. Eventually pressurization was achieved, and the suit became unnecessary. However, experimental models were produced until 1945 and tested under simulated high-altitude conditions. There was no opportunity for operational testing because War II planes seldom flew higher than 35,000 feet and pilots got along all right with oxygen masks.

In 1949, because of the altitudes attained by jet and rocket research aircraft, the need to create an artificial environment for the pilot became apparent. Goodrich offered its assistance to the Navy and received a contract for an improved type based on the principles it had developed. The model seems to be generally similar to the T-1 announced last fall by the Air Research and Development Command, U. S. Air Force. The T-1 embodies a crash helmet, oxygen mask, earphones, microphone, goggles, defroster and oxygen bailout bottle. It had an unexpected and unplanned test when the cabin of a Bell X-1, a rocket-powered research craft, lost pressurization while the plane was flying out of Edwards Air Force Base, Calif., with Lt. Col. Frank K. Everest at the controls. When the suit automatically inflated he knew what was happening and was able to save his life and the multimillion-dollar craft.

The following concerns produced the major equipment for the T-1 suit under Air Force contracts: David Clark Company, Worcester, Mass.; International Latex Corporation, Dover, Del.; Bendix Aviation Corporation, Teterboro, N. J.

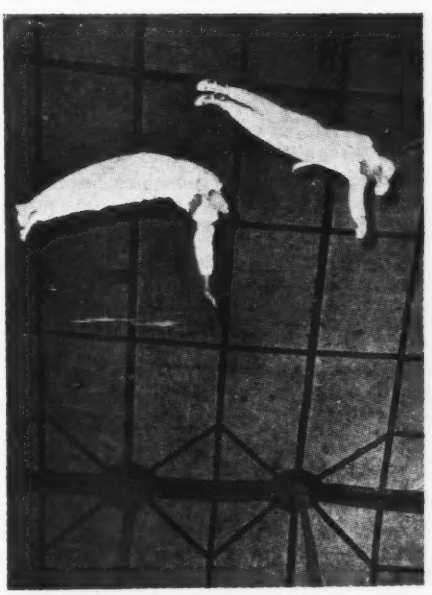
Human Cannonballs Now Fly in Pairs

A NEW twist has been given the spectacular circus act of shooting a human being from a makeshift cannon with a charge of compressed air. In Germany, a boy and a girl now leave the muzzle together and travel 70 feet into a net.

Eduardo Zacchini, an Italian, originated the act on the Isle of Malta in 1922 after much experimenting. He made his own cannon of aluminum for lightness. Compressed air at 200 psi pressure was stored in a chamber at the base and released by a quick-opening valve at the appointed instant to actuate a piston and thus eject the human projectile from the bore at high speed. A firecracker and smoke gave the illusion of an explosion.

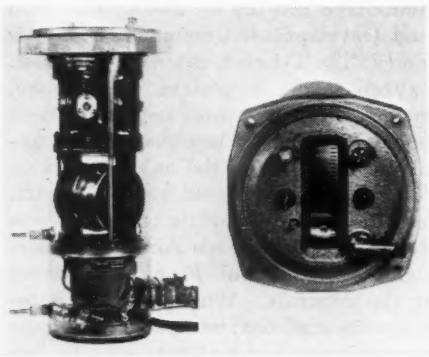
Zacchini performed his sensational maneuver the world over, and then his daughter Victoria took his place and traveled with the Roy Rogers Circus. At the time we covered the act in January, 1948, she had been shot out 2000 times without sustaining a scratch. Heavy clothes are worn for protection against skin burns from friction.

The dual actors are Leon Dinnat and Jarina Seflova. One of our pictures shows them occupying separate compartments in the barrel of the cannon for a takeoff, and the other one caught them flying through space "with the greatest of ease." They say they have only two worries: that the cannon be inclined exactly at an angle of 48° from the horizontal to give them the desired trajectory and that the air pressure be just right to give them the correct push.



Industrial Notes

Fischer & Porter Company has developed a portable pressure-measuring instrument that is said to be as accurate as the most sensitive mercury manometer but far more rugged and convenient to use. Called the Press-I-Cell (pronounced precise cell), it is said to meter with an accuracy of one part in 5000 and to have a sensitivity of one part in 15,000 though the instrument is only 5 inches in diameter and 14 inches long. Its 600-inch scale is calibrated in intervals of 1/16 inch, which represents 1/10,000 of the full pressure range, and is printed on a 35-mm strip of film that is virtually unaffected by temperature and humidity changes. Two models are available: one in which the proper scale position is set manually and the other in which that is done by a servomotor. The meter is not intended as a substitute for standard measuring instruments used where extreme accuracy is not required.



SIDE AND TOP VIEWS

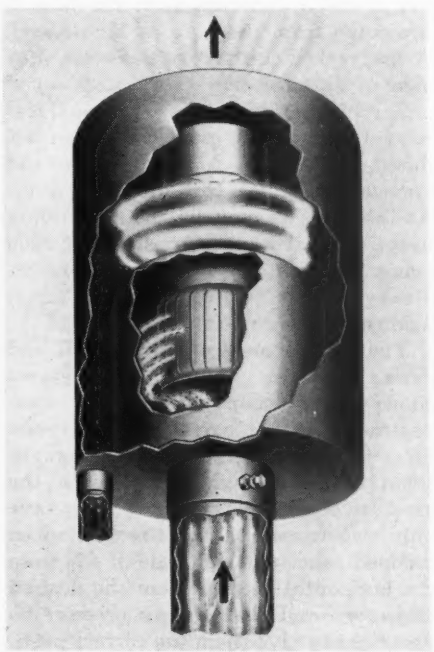
Shown at the left is the automatic pressure-measuring instrument with its transparent case and scale removed. The servomotor is at the bottom. The only part exposed when the meter is mounted in a panel is the top that gives the reading. The scale pictured at the right belongs to a manually operated Press-I-Cell.

After June 30, buses and trucks provided with air brakes and engaged in interstate traffic will have to be equipped with an audible or visual signal that will give warning of pressure failure in the air line leading to the brakes. With this in view, Rochester Manufacturing Company has designed a pressure-operated switch actuated by a diaphragm in a steel housing 1½ inches in diameter. When the pressure in the air line drops below a predetermined point, the diaphragm closes the switch contacts to sound an alarm or light a lamp.

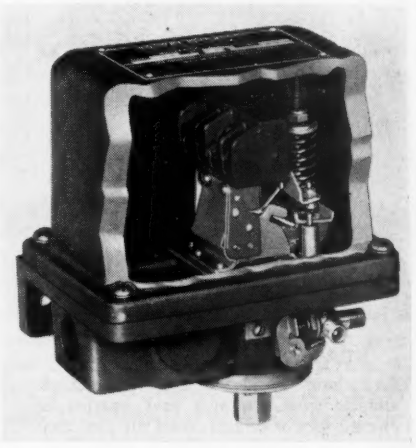
Natural, synthetic or silicone rubber is being bonded in specified thicknesses to metalwork by a special process developed by Advance Rubber Company, which is set up to coat parts supplied by customers. For certain products a resilient covering would be a decided advantage. Metal inserts in rubber bushings, for example, would give them rigidity, and rubber-metal valves would provide a seal of more than normal tightness at high and low pressures even where grit is present. Parts of well-nigh any shape can be processed, and components with metal cores can be ground to tolerances of 0.002 inch, plus or minus.

According to a study made by General Electric Company, the nation's railroads have made a phenomenal gain in electrical generating capacity in the last decade. Today they are equipped to produce 18,000,000 kw, or 900 percent more than in 1942 when the available units were barely sufficient to develop 2,000,000 kw.

Pollution of the atmosphere has many strikes against it, and anything that is designed to help overcome the nuisance deserves consideration. The V. D. Anderson Company is offering something new in exhaust heads for industrial smokestacks that is said to remove objectionable oil, process liquors, etc., from exhaust steam and vapors before they are vented. Upon entering the purifier, the steam encounters a stationary centrifugal element that imparts to it an extremely rapid rotational motion, with the result that any entrained dirt particles, guck, oil or moisture is thrown outward against the wall where it flows down and out into a drain while the clean, dry steam is discharged into the atmosphere. As the unit has no moving parts or filters, maintenance is negligible. Standard models are provided with a slip-on or flange connection for the stack and a threaded drain connection, but purifiers are made to specifications. The stationary centrifugal element upon which the effectiveness of the head depends is a new design developed by the company.

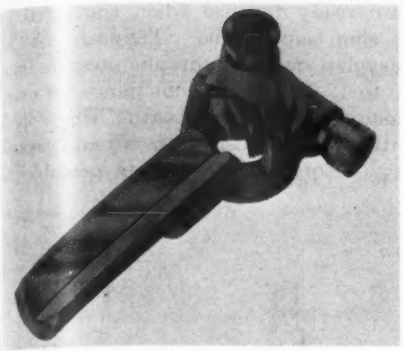


For service in the presence of explosive atmospheres or where highly combustible fuels are handled, Square D Company has introduced a new pressure switch for water pumps and air compressors. It is housed in an explosion-resistant enclosure that is designed to meet Class I Group D specifications and is available in two types. The pump switch is designed for a pressure range of 20 to 80 psi and the compressor switch for 40 to 200 psi. The latter is obtainable with a 2-way release valve. The operating mechanism is of the snap-action type insuring positive contact regardless of range or differential spring adjustment. Internal parts are protected against corrosion, and diaphragms of impregnated fabric are provided except where applications call for oil resistant diaphragms.



As a substitute for mica and other Class-B insulation, Natvar Corporation is making a tough, flexible material trade-named Aboglas. It is composed of two layers of open-weave Fiberglas with a core of varnish-impregnated asbestos paper and is furnished in sheets measuring 36x36 inches.

More accurate drilling and longer tool life are assured, it is claimed, by the use of an optically precise gauge developed by F. T. Griswold Mfg. Company for the inspection of drill points. With its Drill Point-Chek, says the manufacturer, it is an easy matter to determine whether lips of new or resharpened drills have been ground to equal angles and lengths. Any angle of point up to 145° can be measured in a few seconds, and any 2-lip drill from No. 80 up to 1 inch,



as well as drills with angles for countersinking, counterboring chamfering or for special purposes, can be gauged. The error in angle is established by a micrometer barrel graduated in degrees.

Safety prompted Arrow Engineering Company to develop a small stirrer for lacquers, paints, oils, solvents, chemicals and other flammable liquids. It consists of a stainless-steel shaft, 12 inches long, with a 2½-inch impeller at the bottom and is driven by a pneumatic motor rated at 1/6 hp when operated with air at 80 psi. Pressure used depends upon the liquid being mixed, and ranges from 35 to 100 psi.

For materials and products that are to be marked for permanent identification there is now available a fast-drying ink that is said not to chip or peel and to be unaffected by heat and weathering. It is made by John P. Nissen, Jr., Company, Glenside, Pa., and sold in a burstproof tube with a ballpoint attachment designed for use on rough surfaces

and furnished in different sizes. The ink is obtainable in six colors and suitable for marking castings, bar stock, tools, dies, fixtures and the like, as well as fur, wood, plastics, and other materials.

At one stage in the manufacture of newsprint the film of pulp, which is about 80 percent water, has to be transferred from the forming wire of the Fourdrinier machine to the first press section. That has always been a ticklish operation as generally performed and has slowed up production because of frequent breakage of the soggy sheet. This is obviated, we are informed, by a vacuum pickup and transfer system developed by the Beloit Iron Works. By means of it, suction carries the wet film to a felt blanket, to a transfer section, and thence to another felt that delivers it to the drying sections at speeds of 1600 feet per minute (modern newsprint machines generally operate at the rate of 1500 feet per minute).

American Rectifier Corporation has announced that it is now carrying in stock standard unit rectifiers from 3 to 50 kw, thus preventing delays unavoidable when custom built. They are designed to convert a-c to d-c current at the flick of a switch and require no warm-up period. Maintenance is said to be nil because of the absence of brushes, bearings, rotating windings, glass or metal tubes and foundations. The complete range of sizes made by the company ranges from 3 to 1000 kw, and 50 to 10,000 volts d-c output.

For bearings, spindles, gearboxes and small air-powered devices, C. A. Norgren Company is offering a Micro-Fog Lubricator that is designed to produce an extremely fine oil fog at low air flow. Among the advantages claimed for the unit are: constant oil level that insures a uniform rate of feed; 360° visibility of the oil flow; accurate pneumatically

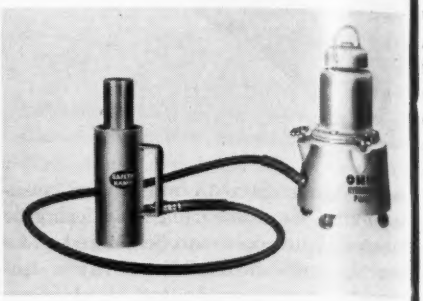
controlled metering of oil into the air line of as little as one drop in twenty minutes; and universal right to left or left to right flow without adjustment. Rated air requirements range from 0.8 cfm at 10 psi to 6 cfm at 80 psi, and maximum safe operating pressure and temperature are 150 psi and 120°F, respectively. The lubricator is suitable for ¼-inch air lines.

In the Hy-Lo type salamander announced by Scheu Products Company, the consumed gases are returned to the bowl of the unit, thus eliminating soot and smoke and improving combustion. Designed to heat small confined areas, it burns from 10 to 20 hours on one filling and is said to produce up to 140,000 Btu per hour using kerosene.

"Makes floors glow and bugs go" is the slogan for a floor wax that is also said to be a strong insecticide. Self-polishing and skid-resistant, it can be applied to cement, asphalt, rubber tile and linoleum, as well as varnished and painted wood floors. A product of Freewax Corporation, it is marketed under the name of Freewax.

It is reported by Abraham Dor, chief engineer of Israel Mining Industries, that King Solomon's Mines have been discovered on the strength of clues found in the Bible and modern archeological research. The State of Israel is planning to work the ancient copper deposits, from which it expects to extract 100,000 tons of ore by July 1, 1953.

Hydraulic pumps and safety rams of new design have been announced by Powermatic, Inc. The former may be used directly with any cylinder, ram, press, jack or other type of hydraulic device, while the ram serves at all times to protect both the operator and equipment from harm. The pumps are powered with air from 70 to 150 psi and are ready for use when connected to a shop supply line. They are said to develop smooth hydraulic pressure from 0 to 12,000 psi without danger of overloading and of overheating when operating continuously at maximum capacity. Equipped for either portable or



stationary service, they weigh 35 or 42 pounds, depending upon the model, of which there are eight. The safety ram may be used with any type or make of pump and is designed to unload itself automatically to prevent plunger "pop-out." There are eight sizes of 20, 35 and 70 tons capacity.

Superior Tube Company is now manufacturing seamless tubing in outside diameters ranging from 1¼ to 2 1/16 inches, sizes previously available only in welded form. It is supplied in three grades of stainless steel and in Monel metal with a wall thicknesses of 0.01 to 0.035 inch.

QUOTES

—FROM HERE AND THERE

Deserves Retirement

"One of the lesser known colliery workers . . . is the colliery pick sharpener. Although his craft is slowly dying in the face of mechanization, (he) is a skilled worker who, in his pithead forge, can readily assess the conditions encountered by the miner at the coal face from the amount of work he has on hand. As in most other fields, inventions have been introduced to make the colliery pick sharpener's task easier, for to make a miner's pick fit to cut coal the point of the tool must be square and really sharp.

"One member of this band of craftsmen is Mr. Ernest Hardy, who has retired after 38 years in the forge at Markham Main Colliery, Doncaster. During his 52 years on the job, Mr. Hardy estimates that he has put a fresh point on nearly 1,500,000 picks—having dealt with an average of 600 tools a week. His apprenticeship, which lasted seven years, was served in Derbyshire. As a token of esteem, his workmates at Markham Main have presented him with a wristlet watch."

Iron & Coal Trades Review (London), January 16, 1953

Landmark Razed

A steel telephone tower in the heart of Stockholm, Sweden, was recently dismantled following damage sustained from fire in the telephone building on which it rested. Of its history, the Swedish-International Press Bureau writes:

"Built in 1887, the tower served as a giant crossarm, gathering all overhead wires from telephone subscribers in the city and also junction lines to satellite exchanges. The number of lines . . . increased year by year and eventually, according to a columnist, 'darkened the sky over Stockholm.' The tower remained as visual testimony to the great intensity of the telephone traffic . . . for 20 years until the overhead lines were gradually replaced by underground cables.

"Originally the tower had a somewhat truncated appearance but in order to appease public clamor for something more attractive, the structure was provided with four corner spires. Its prominent position made it a natural signal mast and it was frequently used to announce a variety of events. The hoisting of a yellow flag, for instance, was a signal that the 'Flying Baron,' one of Sweden's aviation pioneers, could take off, while a white flag with a big S mark announced that there were herring in plenty to be had at the fishmongers."

Books and Industrial Literature

Compressed Air Power in Industrial Production is the third in a series of engineering studies released by Compressed Air and Gas Institute and is intended to familiarize designers, engineers and production men in industry with pneumatic tools and facilities so they will be in a better position to evaluate them and install or design manufacturing equipment that will use air power to the best possible advantage. Applications are discussed comprehensively and include actuation by pneumatic cylinders, agitation of liquids, blast cleaning, chipping, scaling, clamping, drilling, forging, grinding, hoisting, molding, die casting, ramming, riveting, nut running, spraying and instrument control. The 36-page pamphlet contains 63 photographic illustrations and line drawings, together with thirteen tables that give valuable information on air consumption, number of tools that can be operated by compressors of varying sizes, etc. The book is punched for insertion in a standard 3-ring binder and can be obtained from Compressed Air and Gas Institute, 1410 Terminal Tower, Cleveland 13, Ohio. Price, twenty-five cents.

Machine Shop Tooling is the title of a 344-page handbook that was written for the man at the machine by Charles C. Williams and embodies data supplied by more than 50 cooperating manufacturers of tools and materials. Bound with an oil-resistant cover, the text matter is arranged in alphabetical order like a dictionary for easy reference and includes much original material, as well as a section on troubles with machine tools and materials and what to do about them. Published by Wilco Press, 3326 N. Bailey Street, Philadelphia 29, Pa. Price, $3.00.

The Commercial Intelligence Office, Oudebrugsteeg 16, Amsterdam-C, The Netherlands, issues a bulletin, *Buvoha Mededelingen*, every two weeks in which foreign firms may list products they desire to export and make inquiries concerning imports. It has a circulation of 5000 among industrial and commercial firms in Holland. Once each year the *Buvoha Trade Letter*, which lists Dutch firms looking for new business connections abroad, is distributed in all countries of the world. A copy of the latter may be obtained by writing to the Intelligence Office.

An improved model filing machine for die making that also saws and hones is the subject of a 4-page folder being distributed without cost by All American Tool & Mfg. Company, 8027 Lawndale, Skokie, Ill.

Pittsfield Products, Inc., 2275 Platt Road, Ann Arbor, Mich., is distributing a new catalogue dealing with its line of wire-cloth and perforated-metal screens, strainers and filters of a wide range of shapes and sizes.

Allis Chalmers Manufacturing Company, 1000 South Seventieth Street, Milwaukee, Wis., is offering a new bulletin (20B-6497A) on its Texrope grommet V-belt which is made without a splice and is said to give exceptionally long service.

Catalogue C2-4 now obtainable from Flexible Tubing Corporation, Guilford, Conn., describes its Spiratubes and Flexflyte (tubing less than 3 inches in diameter) for ventilating purposes, dust and fume removal, and materials handling.

Where to Use Coal Tar Protection is the title of an illustrated brochure released by

Tapecoat Company. It is based on years of experience in the field of combating corrosion and can be obtained from the company at 1523 Lyons Street, Evanston, Ill.

American Standards Testing Bureau, Inc., 44 Trinity Place, New York 6, N.Y., is distributing free of charge a new bulletin which lists 80 different methods of testing, inspecting and analyzing some 90 different kinds of products and describes the scope of its services in this field.

General Electric Company, Schenectady 5, N. Y., has released two bulletins on its Thy-mo-trol (thyratron motor control) drive. GEA-5829 describes a simplified drive for ¾- to 3-hp application and GEA-5827 a precision drive for ¾ to 10 hp. Copies are available upon request.

American Ventilating Hose Company has released an illustrated catalogue, No. 35, which contains installation and other pertinent data about its improved types of Flexaust—spiral wire-reinforced flexible hose for many applications. Get a copy by writing to the company at 100 Park Avenue, New York, N. Y.

In Bulletin 88-A the Niagara Machine & Tool Works, 637 Northland Avenue, Buffalo 11, N. Y., describes its 6-inch series all-steel bending rolls for forming cylinders, cones, rectangles and ovals from sheet steel. Literature shows how machines operate and lists capacities and special features for cutting grooves, etc.

Mead Specialties Company has released the 1953 edition of its Air Power Catalogue. The 56-page book is profusely illustrated and covers the firm's complete line of air-operated cylinders, chucks, presses, vises, valves, hammers and work feeders. Address requests for copies to Department P-13, 4114 North Knox Avenue, Chicago 41, Ill.

Ajax Engineering Corporation, Trenton, N. J., has issued an illustrated folder descriptive of its new combination induction holding furnace and pouring machine for die-casting aluminum and zinc alloys. Method of operation and characteristics of the unit, called Ajaxomatic, are dealt with, and an installation diagram is included. Copy will be sent free upon request.

Stucco Finishes Made with Pliolite S-5 is the title of a 16-page manual printed by Goodyear Tire & Rubber Company, Akron 16, Ohio. It deals comprehensively with the use of this thermoplastic resin as a vehicle in protective coatings for masonry, recommends grinding and finishing techniques, and lists applications. Requests for copies of the book should be addressed to the company's Chemical Division.

Bulletin 350 published by W.H. Nicholson & Company, 12 Oregon Street, Wilkes-Barre, Pa., describes its new Type D industrial steam trap. Smaller in size and capacity than other models, it embodies several improvements such as hexagon shanks of generous size to accommodate standard wrenches, rugged internal guide rod and tube, and a removable stainless-steel valve and seat. Copies of the bulletin can be obtained upon request.

Simplex Valve & Meter Company, Sixty-eighth and Upland Streets, Philadelphia 42, Pa., is offering a general catalogue on its measuring and control equipment for water and sewage works and power and processing industries. A 28-page book, it lists and describes many types of gauges, manometers, valves, venturi tubes, controllers etc., and contains data on mountings and operating characteristics. Ask for Catalogue 003.

Eimco's Work Faster! Keep Job Costs Lower

Contractors, on all types of jobs, know that Eimco's will consistently save them money as an all around tool on general maintenance jobs, special repair jobs or new construction.

Take a job of loading sand or gravel. Eimco's will load from 4 to 6 yards per minute, and keep it up. This is a loading speed that invites comparison with heavier, more expensive equipment.

Eimco's are also good at digging unbroken ground for new roads, soil-silt deposits in riverbeds, taking up highway curb or shoulders, loading snow, clearing winter sluff, digging out frost blisters or digging ditches culverts or the toughest kind of rock loading.

Write for complete information on Eimcos stating your type of loading problem.

You Can't beat an Eimco

EIMCO

1437

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

EXECUTIVE OFFICES AND FACTORIES - SALT LAKE CITY 10, UTAH, U. S. A.

BRANCH SALES AND SERVICE OFFICES:

NEW YORK, 51-52 SOUTH STREET • CHICAGO, 2319 SOUTH WALLACE STREET
BIRMINGHAM, ALA., 3140 FAYETTE AVE. • DULUTH, MINN., 216 E. SUPERIOR ST.
EL PASO, TEXAS, MILLS BUILDING • BERKELEY, CALIF., 637 CEDAR STREET
KELLOGG, IDAHO, 307 DIVISION ST. • LONDON W. 1, ENGLAND, 190 PICCADILLY

IN FRANCE: SOCIETE EIMCO, PARIS, FRANCE
IN ENGLAND: EIMCO (GREAT BRITAIN) LTD., LEEDS 12, ENGLAND
IN ITALY: EIMCO ITALIA, S.P.A., MILAN, ITALY